DYNAMICS

The Official Journal of the Canadian Association of Critical Care Nurses

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I came for the job. I stayed for the team.

"I love the dynamic and ever-changing nature of my job. Every day is different! I work with fantastic people that constantly inspire me."

Kerry B., Registered Nurse

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I am writing this piece after recently returning from a weekend at the Winnipeg Folk Festival. This year, the festival celebrated its 33rd year. What struck me, as a sat and listened to the music, enjoyed the sun and participated in my favourite sport of people-watching, was there were a lot of people in the field. Apparently more than 9,000 of us! It also occurred to me, as I flipped through the program, that events such as this require a lot of people-power in order to happen, to be successful and to grow. The interesting thing was that there were 12 people who were singled out for having volunteered for at least 30 of the 33 years. Remarkable!

What does this have to do with CACCN? Well, we will be celebrating our 25th anniversary in 2008. As I thought about this milestone, my mind wandered to the board of directors and I thought about the many, many hours the board has spent volunteering on behalf of CACCN – this board and all the boards before us. It occurred to me that without dedicated, committed people, CACCN would not have survived for more than 25 years. Critical care nurses would be deprived of the voice they have at the national and international level. Events such as Dynamics would not exist. Nor would Dynamics, the Official Journal of CACCN. But, fortunately, we have people who are willing to give of themselves for the benefit of the association, for nursing and, ultimately, for our patients and their families.

In looking at the names of those who volunteer on behalf of CACCN, I noticed that the same names appear over and over. Is it because these people have nothing better to do? Likely NOT! Perhaps they like the “glory”? I doubt that, because when one commits to volunteering, there is usually work associated and if volunteers are in it for the glory, they soon realize that this gets old FAST! I believe it is because they are driven by the desire to participate, to give back and to be involved in positive change. The ideal volunteer is not afraid of hard work, is willing to give of themselves and their time and has a belief, a vision and commitment to being “part of the solution”. Is it all a selfless act? I don’t believe so. There is much to be gained by volunteering: an opportunity to meet amazing people, to learn, to be mentored, to challenge oneself, to be part of something big and positive.

Being part of CACCN, whether at the local or national level, is a fabulous opportunity to give of oneself and to receive so much more in return. Many of the volunteers join because “someone asked them to” or they were encouraged by others. It seems people often think they would like to volunteer, but are never sure they should, or can, or would be welcome. Well, I would like to invite you to volunteer because I think you should, you can and you would be most welcome. Start small. Contact your local chapter for opportunities to “help out”, join the local executive or, if you have done that, consider the next step; joining the national board. We are currently seeking two board members to represent western Canada and one for eastern Canada. If you or someone you know is interested, please contact caccn@caccn.ca for more information.

To those who have volunteered on behalf of CACCN over the past 24 years: thank you for your time, commitment, sacrifice and vision. Without volunteers, CACCN, like the Winnipeg Folk Festival, would not have survived, grown and flourished.

Asha Pereira
President

NOTICE OF ANNUAL GENERAL MEETING

The national board of directors of the Canadian Association of Critical Care Nurses (CACCN) would like to extend an invitation to the membership to attend the 2007 annual general meeting of the CACCN. The CACCN annual general meeting will be held on Monday, October 22, at 1630-1730 hrs, in the Novara Room of the Delta Regina Hotel in Regina, Saskatchewan. Members unable to attend the annual general meeting are reminded that their proxy vote must be received in CACCN national office by midnight, Friday, October 5. The proxy vote form is printed on page 8, and can also be obtained from your chapter president or CACCN national office.
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Does CACCN set or endorse standards for nurse-to-patient ratios for critical care?

CACCN response:

CACCN does not set a specific standard for nurse-to-patient ratios in critical care. However, under the CACCN’s Standards for Critical Care Nursing Practice 3rd edition, Outcome Standard 3, the criteria set under clause 3.4 states: “The health care facility ensures that each unit develops written guidelines for nurse/patient ratios and defined ratios of levels of nursing staff.”

The question of what is the recommended nurse/patient ratio seems like it should be straightforward but, in fact, as every critical care nurse knows, the issue is very complex and the answer is “it depends.” The American Nurses Association (ANA) and the Canadian Nurses Association (CAN) agree that three factors that significantly influence appropriate safe nurse/patient ratios are:

1. Nursing Unit Related – which includes factors such as the number and acuity of the patient population; the location of the unit; available technology and the level of preparation and experience of the nursing staff. Other considerations include the age and functional ability of the patient population, availability of social supports and a number of other factors. Overlying all of these factors is the model of nursing care delivery in place.

2. Staff Related – Characteristics of nurses that influence appropriate staffing levels include: the experience working with a particular patient population; level of individual nursing experience (from novice to expert); education and preparation (including certifications, level of control over the practice environment, language capabilities, degree of involvement in quality initiatives, participation in nursing research) and competencies of other clinical and non-clinical staff the nurse must work with and/or supervise.

3. Organization Related – Consideration of many factors such as appropriate ancillary support services (e.g. housekeeping, laundry, laboratory), the presence of non-RN nursing care providers, access to timely and relevant information, appropriate orientation and continuing education are some of the issues that need to be considered.

O’Brien-Pallas, Thomson, McGillis Hall, Pink, Kerr, Wang, et al. (2004) conducted research looking at the optimal workload of nurses. This has generated some evidence-based standards that indicate a goal for optimal workload productivity/utilization for a unit should be to aim for 85% with a maximum utilization not to exceed 93%.

In June 2003, the CNA issued a position statement entitled, “Staffing decisions for the delivery of safe nursing care”, which outlines key principles and criteria for the delivery of safe nursing care. The full document is available on the CNA website at www.cna-nurses.ca/CNA/issues/position/practice/default_e.aspx

More recently, Dr. Gail Tomblin Murphy was commissioned jointly by the Canadian Federation of Nurses Unions and The Office of Nursing Policy, Health Canada, to conduct a multi-phase project to examine if formal, mandated nurse-patient ratios would enhance patient safety while at the same time respect professional nursing judgment.

The first phase of the project, conducted in 2004-2005, comprised a literature review of published and unpublished reports from government, the academic community and professional organizations across Canada and abroad. Her final report entitled “Nurse-Patient Ratios and Staff Safety: A Review of the Literature” issued April 4, 2005, examines the pros and cons of nurse-patient ratios as a staffing policy and reviews the experience of other jurisdictions, in particular
California and the State of Victoria in Australia, where legislation is in place to mandate specific nurse-patient ratios in health organizations. Her final report from phase one is available on-line at: http://www.nursesunions.ca. This report is probably the most comprehensive overview and synthesis of the issues and factors influencing appropriate nurse/patient ratios. Her two recommendations emphasize the need for further examination, consultation and applied research within a Canadian context followed by the initiation of a nurse-patient ratio pilot project in an appropriate setting to test the use of mandatory nurse-patient ratios as a staffing model.

So, in summary, other than two jurisdictions in the world (California and State of Victoria, Australia), there are no standard or regulated nurse-to-patient ratios. Even in those two jurisdictions, there is no solid evidence to support that mandating nurse-patient ratios is having the intended effect of improving patient safety.

In closing, as critical care nurses, we recognize that patient safety and quality of care is heavily influenced by nurse-patient ratios within the many factors that have been outlined by the CNA and the ANA. Linked closely to this is job satisfaction and retention of nurses. This issue remains one needing a strong representation from critical care nurses to influence policy. Currently, such an opportunity to have your voice heard is available through an invitation to join a Canadian network looking at the issue. The Canadian Health Services Research Foundation, Canadian Patient Safety Institute and the Canadian Nurses Association have partnered to develop the Nurse Staffing and Patient Safety Knowledge Network. Its purpose is to promote evidence-informed nurse staffing in health care facilities in Canada. This knowledge network is housed on NurseONE, the Canadian nurses portal. They are seeking interested decision-makers who are involved in nurse staffing, as well as patient safety issues. You can view the full Expression of Interest online by accessing the CNA web page.

The time to speak is now!

Kate Mahon,
Director, Eastern Region

References
CACCN calendar of events

DATES TO REMEMBER!

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<td>October 18-19, 2007</td>
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<td>Application deadline to write CNCC(C)/CNCCP(C) exam in 2008</td>
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<td>February 15, 2008</td>
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Call for task force members – Dynamics 2009

Dynamics 2009 will be held in Fredericton, New Brunswick, and will be chaired by Cecilia St. George-Hyslop. Any CACCN member interested in working on this committee should submit a resume and summary of conference planning experience to the CACCN national office by March 1, 2008. Selection of the task force members will take place in March 2008. For further information on this exciting opportunity, please contact the CACCN national office, P.O. Box 25322, London, Ontario N6C 6B1, www.caccn.ca, e-mail: caccn@caccn.ca, phone: (519) 649-5284, fax: (519) 649-1458.
Abstracts are currently being accepted for oral and poster presentations for Dynamics 2008, to be held in Montreal, Quebec, September 28-30, 2008. Topics of interest include clinical reviews and research, innovative projects and solutions, and ethics. All submissions must be evidence-based and ideally address the conference theme: “Celebrating 25 Years of Critical Care Advocacy. Past, Present and Future”.

Abstract submission guidelines
Submissions for Dynamics 2008 will be accepted as:
- Hard copy and CD ROM (Word) OR e-mail and attached files (Word)
- Submissions must include the following:
  • Abstract: maximum 300 words, include only title and abstract (do not identify author(s) on abstract)
  • Reference List: reference list in APA format (maximum 2 pages)
  • Presentation Information: (separated from the abstract and references)
    - identify preferred format of presentation (oral or poster)
    - list names of all authors
    - provide contact information for first author including: name, fax number, mailing address with postal code, home and work telephone numbers, and e-mail address
  • Presentation experience:
    • for each author, indicate presentation experience (frequency, location of presentation, audience size, evaluation summaries and references)

Important note
• Only completed submissions received by midnight, January 31, 2008, will be considered.
• All correspondence will be with the first author only.
• One presenter for each accepted abstract will be entitled to a discounted tuition.
• All other expenses are the responsibility of the presenter(s).
• Notification regarding selection decisions will be provided by March 1, 2008.
• Abstracts accepted for presentation at Dynamics 2008 must not be presented at a national or provincial level for a period of 12 months prior to, and/or six months after Dynamics 2008. Abstracts are the property of CACCN during this period of time, and may be published in Dynamics, The Official Journal of the Canadian Association of Critical Care Nurses.

Please Send Submissions To:
Dynamics 2008 Abstracts,
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You showed up on our doorstep
With fear written across your face
Our eyes meet and yours ask
What is happening to me?
Will I survive?

In a flurry of activity
Strangers come and go
Your gaze follows all the action
Sensing urgency in the air
You know not what to feel.

Finally things are quiet
It is only you and I
I explain what is happening
Predict and answer questions
Attempt to ease your fears.

I will monitor your progress
Assess your changing needs
Collaborating with my colleagues
Discuss the whole of you
Your wellness is our goal.

I won’t forget your family
Your being removed from them
They help me get to know you
I help them to understand
They are part of the team as well.

The winner has received a free tuition to Dynamics 2007 being held in Regina, Saskatchewan.

Thank you for all of your submissions to CACCN’s Nurse’s Week Contest, “Think You Know Nursing? Take A Closer Look”. It was a difficult decision.

Look for our contest next year during Nurse’s Week to win a free tuition to Dynamics 2008 being held in Montreal, Quebec.

Future sites of Dynamics conferences

Dynamics 2008 Montreal, Quebec
Dynamics 2009 Fredericton, New Brunswick
Dynamics 2010 Edmonton, Alberta
Dynamics 2011 London, Ontario

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The Canadian Association of Critical Care Nurses (CACCN) would like to congratulate and acknowledge our members who have obtained the CNCC(C) or CNCCP(C) certification through the Canadian Nurses Association (CNA) in 2007.

**CNCC(C)**

I Reagan Bartel
I Suzanne Berube
I Andrea Bodnar
I Jo-Ann Correa
I Sean De Jardine
I Brenda Gallagher
I Nathalie Goulet
I Judith D. Hackett
I Chad Johnson
I Leah Johnson
I Catherine Judd-Morin
I Jennifer Keenan
I Debra Kelly
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I Steve R. Ramganesh
I Leanna L. Ritchie
I Teresa L. Robitaille
I Lynn O. Shortt
I Diane Smetheram
I Michelle Soberepana
I Laura Steeves
I Richard Sutherland
I Brandi L. Vanderspank
I Cathy Walsh
I Jennifer A. Wright
R Sheryl Alexandre
R Stephanie A. Bedford
R Joan A. Bennett
R Janine Boston
R Jill Butt
R Valerie A. Clark
R Cindy-Lee G. Cosby
R Jennifer Cruz
R Ingrid A. Daley
R Isobel Davis
R Melinda A. Falda

**CNCCP(C)**

R Donna M. Forrester
R Sharon Forster
R Marie E. Frederick
R Lori A. Garchinski
R Pamela Jean Hughes
R Christina J. Hurlock-Chorostecki
R Mary Lynn Iacobellis
R Cheryl L. Isaak
R Constance Kpodo
R Pamela A. Locke
R Shirley M. Macgowan
R Mary Maselli
R Kerryl M. Mcdonald
R Moira E. Mcneill
R Daisy Y. Morgan
R Dianne S. Morley
R Denise A. Morris
R Mai Nguyen
R Penny L. Nickle
R Carol C. O’Hearn-Downey
R Janet E. Paton
R Arlene M. Renn
R Marian E. Roach
R Angela Ryan
R Lynn J. Safroniuk
R Heather F. Sartori
R Sheila R. Smith
R Kirsten E. Snyder
R Susan M. Stuart
R Lois E. Thomas
R Jasna Tome
R Ruth A. Topelko
R Allison G. Tugwell
R Dianne Walkom
R E. Thomas Willis
R Tuberyl R. Zaheeruddin

(R) Renewal includes Continuous Learning and Exam
(I) Initial includes Initial, Reciprocity and Exempt candidates

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CERTIFICATION

Exam Date: April 5, 2008

Initial Certification Exam Candidates
Application Deadline: October 19, 2007

Maintain your credential
Certification Renewal by Continuous Learning or Exam Candidates
Application Deadline: November 23, 2007

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Research Review

Citation

Purpose
To explore the significance of acts of kindness and commemoration by staff members (including attending funerals, sending sympathy cards, sending cards on birthdays/anniversaries, telephoning/visiting family homes and attending memorial services at the hospital) for bereaved parents of children who died in PICU.

Research design
This is a qualitative, focused ethnography study.

Setting
The hospital where the study was carried out is one of two tertiary pediatric hospitals in a Canadian city of approximately three million people. Parents were recruited from the 12-bed PICU within this multicultural, multilingual hospital.

Sample
Twenty families were eligible, having a child die in PICU between nine and 18 months before recruitment (April 2001 to June 2002).

Eight families agreed to participate, 12 parents were interviewed:
- Eight mothers & four fathers (all parents were part of two-parent families)
- Seven interviews were conducted in English and five in French
- Many families were from multicultural backgrounds
- Voluntary and written consent were obtained
- No siblings or extended family members were successfully recruited for an interview. Explanations were that parents did not want their children or relatives to be reminded of the death, or they were simply not interested

Methods
After reviewing relevant literature, the researchers chose topics for investigation (hospitalization, interventions, communication, decision-making, family functioning, social supports and bereavement), and developed interview questions. A multidisciplinary team was involved in creating an interview guide designed to elicit specific family experiences. This guide evolved and was refined as the interviews were conducted. One or both parents participated in a semi-structured, audio-recorded interview with two researchers and one research assistant. Prompts were used to initiate discussion on the chosen topics, however, parents were permitted to guide the conversation or add discussion topics.

The multidisciplinary team then analyzed the interview data using team triangulation and cross-case inductive analysis to identify prominent themes.

Main findings
Three salient themes evolved: (1) Parental opinions regarding the memorial service (2) Parental experiences in returning to the hospital, and (3) Parental thoughts about staff members’ acts of kindness after the child’s death. Months later, parents remembered positively the staff members who engaged in acts of kindness or commemoration. Furthermore, parents expressed disappointment when staff members did not engage in these activities and/or were absent from memorial/funeral services.

Discussion
The experiences of parents who have lost a child in PICU were explored, revealing three significant themes. Overall, families appreciated acts of kindness, commemoration and support by staff, as well as the presence of staff members at the child’s funeral and memorial service. Omission of these same acts was also significant to families, a fact of which staff may be unaware. The memorial service was very significant to families as a time of remembrance of their child, as it fostered a sense of community with other grieving families and staff members, and as it encouraged the difficult, but usually positive, experience of returning to the hospital. Overall, it is recommended that staff attendance at memorial services be encouraged and facilitated, that education and guidance be provided to staff members both in their support of bereaved families and in their own personal coping and grief. It is noted that staff be supported in making at least one meaningful contact with the family during the bereavement period as families often regard hospital staff as a “second family”, and the lack of this contact after their child’s death can be regarded as a “secondary loss”. Furthermore, better communication is needed so that all hospital employees who have had contact with the families are made aware of the child’s death. Acts of kindness and commemoration by staff are thought to favourably affect parental bereavement by fostering a sense of community with other parents and staff, by promoting a positive significance of the child’s life, and by facilitating the transition from a prior lifestyle to a new, unexplored lifestyle.

Limitations
One major limitation of this study was that families who declined to participate might have had other perspectives, possibly affecting the accuracy of study conclusions. It is agreed that further research is needed in this subject area due to the small sample size, the need for multicultural data, the inability to recruit siblings and extended family members, and the need to explore different care settings and perspectives.

Commentary
Overall, this article was well-written and carefully organized. This study clearly elicited its purpose and relevance to clinical practice. It addresses a clear gap in research by performing an evaluation of acts of kindness and commemoration after a
child’s death, as well as by focusing on the perspectives of parents. The authors were attentive to issues of informed consent, confidentiality, data security and anonymity. The research design and data collection methods were appropriate to the research objectives. A literature review formed the basis for interview topics, and a semi-structured interview guide allowed for a certain degree of continuity while allowing parents the freedom to direct the conversation. The involvement of a multidisciplinary team throughout all phases of the research study allowed for a variety of expert contributions and safeguards.

A key question with regards to this study is the ongoing refinement of the interview guide as the interviews progressed. Although refinement indicates critical evaluation of this research tool, it is conceivable that family experiences may have been better elicited during the latter part of the study due to the effectiveness of this variable improving over time.

We chose to review this article for several reasons because we felt the topic was very relevant to the work of pediatric critical care nurses in Canada. Pediatric palliative care is a portion of clinical practice that is weakly represented in the literature, likely due to the paradox of a dying child, the obvious emotional challenges this presents, and the relatively small population in this domain (Kristjanson, 2005). This topic also seems to be less frequently discussed in PICU, an area often associated with saving lives rather than end-of-life care. However, the often sudden or traumatic nature of deaths in PICU may indicate a greater-than-average need for expert bereavement care for families and staff (Maunder, 2006). As frontline health care professionals, nurses are in an ideal position to draw attention to the need for improved bereavement care for families and staff alike, and have valuable ideas and experiences to offer. In addition, there is no question that the kind and thoughtful acts of hospital staff already play an important role in the lives of families who have lost a child (deJong-Berg & Kane, 2006). Parents have a unique and important viewpoint of a child’s death; this should be considered a tool to be used by health professionals in the provision of more effective end-of-life care. We hope and expect this research review has drawn attention to the ability of nurses and hospital staff to make a difference in the meaningful bereavement care of families at pediatric hospitals across Canada.

Sarah T. King, RN, BScN, Rebecca Earle, RN, BSc, MSc(N), Nicole Lewis, RN, BN, Staff, PICU, IWK Health Centre, Halifax, Nova Scotia

References


Pulsus paradoxus in ventilated and non-ventilated patients

By Frankie W.H. Wong, RN, BN, MHS, CNN(C)

Key words: pulsus paradoxus, systolic blood pressure difference, spontaneous breathing, mechanical ventilation

Abstract

Human physiology changes are often amplified in disease states and may be altered when a patient is mechanically ventilated. Normally, systolic blood pressure is slightly lower during inspiration than expiration due to the change in intrathoracic pressure. Pulsus paradoxus is a phenomenon in which the difference in systolic blood pressure (BP) between inspiration and expiration is more than 10 mmHg. When a patient is mechanically ventilated, the pattern of changes observed in pulsus paradoxus is reversed; that is, the systolic BP is higher during inspiration than expiration. In this article, the airway pressure and respiratory impedance tracings are used to demonstrate the inspiratory and expiratory phase of the respiratory cycle. Then BP can be determined with each respiratory phase. The difference in presentation of pulsus paradoxus in patients who are breathing spontaneously and with mechanical ventilation is described. A case study is also included to illustrate the presentation and treatment of pulsus paradoxus in a mechanically ventilated patient.

The restructuring of the health care system in recent years has had significant impact on nurses’ functions in the clinical setting. Patients are more acutely ill than ever before and, yet, length of stay has become shorter and advanced technologies have been used to optimize patient outcomes (Wiseman, 2007). Critical care nurses are required to be familiar with the data they collect from various assessment methods in order to effectively manage patient care, monitor their progress, and evaluate the effectiveness of different therapies. Pulsus paradoxus, a phenomenon that occurs in many clinical conditions, may be difficult to detect by measuring blood pressure manually (Jay, Onuma, Davis, Chen, Mansell, & Steele, 2000). However, with invasive arterial blood pressure (BP) monitoring, it is easily observed in the intensive care unit. Pulsus paradoxus can indicate severe airway obstruction (Clark, Lieh-Lai, Thomas, Raghavan, & Sarnaik, 2004) or other life-threatening conditions such as hypovolemia, cardiac tamponade, or tension pneumothorax. Early recognition of pulsus paradoxus is able to guide appropriate interventions.

The mechanism of pulsus paradoxus is controversial (Darovic, 2002; Kinney, Dunbar, Brook-Brunn, Molter, & Vitello-Cicciu, 1998), but the presentation of pulsus paradoxus is the same, depending on whether patients are breathing spontaneously or mechanically ventilated. In this article, the airway pressure, arterial pressure, and respiratory impedance tracings are used to compare the differences in presentation of pulsus paradoxus in patients who are breathing spontaneously and mechanically ventilated. A case study is also used to illustrate the presentation of pulsus paradoxus.

<table>
<thead>
<tr>
<th>Causes of Pulsus Paradoxus</th>
<th>Rationale</th>
</tr>
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<tbody>
<tr>
<td>• Asthma</td>
<td>The narrowing of airways creates a more negative intrathoracic pressure during inspiration, which increases the pooling of blood in the pulmonary vessels (Darovic, 2002).</td>
</tr>
<tr>
<td>• Exacerbation of chronic obstructive pulmonary disease (COPD)</td>
<td>Fluid accumulated in the pericardial sac or tightened pericardial sac impairs left ventricular relaxation (Khasnis &amp; Lokhandwala, 2002). As a result, left ventricular preload, stroke volume, and systolic pressure decrease.</td>
</tr>
<tr>
<td>• Cardiac Tamponade</td>
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<tr>
<td>• Constrictive pericarditis</td>
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<td>• Restrictive cardiomyopathy</td>
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<tr>
<td>• Hypovolemia</td>
<td>The pooling of blood in the pulmonary blood vessels during inspiration further reduces the already lowered left ventricular preload and increases the pressure difference between inspiration and expiration.</td>
</tr>
<tr>
<td>• Distributive shock</td>
<td>Increases in intrathoracic pressure decreases blood return to the heart (decreases preload). Similar to hypovolemia, increased pooling of blood in the pulmonary blood vessels during inspiration further decreases left ventricular preload and cardiac output.</td>
</tr>
<tr>
<td>• Tension pneumothorax</td>
<td>Descent of the diaphragm during inspiration creates traction on an already taut pericardium and impedes left ventricular outflow causing a fall in cardiac output (Darovic, 2002).</td>
</tr>
<tr>
<td>• Pericardial effusion</td>
<td></td>
</tr>
<tr>
<td>• Pulmonary Embolism</td>
<td>A large embolus obstructs blood flow through the pulmonary vessels, which reduces the left ventricular preload (Darovic, 2002).</td>
</tr>
</tbody>
</table>
Definition of pulsus paradoxus
With breathing, there is approximately a 3 to 4 mmHg difference in systolic pressure between inspiration and expiration due to changes in intrathoracic pressure (Darovic, 2002). In some pathophysiologic states, this pressure difference is increased and pulsus paradoxus is evident. The profound decrease in BP was first called pulsus paradoxus by Adolf Kussmaul in 1873 (Bilchick & Wise, 2002; Jay et al., 2000). Pulsus paradoxus is defined as an exaggerated drop of systolic pressure (more than 10 mmHg) during inspiration compared to expiration in normal breathing (Tambrurro, Ring, & Womback, 2002). It can be caused by various cardiac, pulmonary, and non-pulmonary problems (see Table One). Pulsus paradoxus is related to an exaggerated change of the transmural pressure of the heart, or pulmonary blood vessels, or both during inspiration and expiration. This change results from decreased venous return to the heart, pooling of blood in the pulmonary circulation, and decreased blood that reaches the left ventricle during inspiration. Pulsus paradoxus is easily observed when the patient’s BP is monitored by an intra-arterial catheter. However, pulsus paradoxus can also be measured by careful manual BP measurement. To perform a manual measurement of pulsus paradoxus, inflate the cuff 20 mmHg above the systolic pressure. Then slowly deflate the cuff and listen carefully for the Korotkoff sounds during inspiration and expiration. Subtract the systolic pressure between expiration and inspiration. Pulsus paradoxus is diagnosed if the pressure difference is >10 mmHg (Bilchick & Wise, 2002).

Monitoring blood pressure changes during different phases in the respiratory cycle
The airway pressure or respiratory impedance tracing is able to indicate the inspiratory and expiratory phases of the respiratory cycle. Recording the airway pressure or respiratory impedance with the blood pressure tracing simultaneously can accurately identify changes of blood pressure during each phase of the respiratory cycle.

Pulsus paradoxus in spontaneous breathing
With spontaneous breathing, during inspiration the intrathoracic pressure decreases and is then transmitted to the pulmonary vessels (Bellamy & Mercurio, 1986; Marino, 2007). The reduced surrounding pressure (intrathoracic pressure) increases the transmural pressure (intraluminal pressure minus the surrounding pressure) of the pulmonary vessels. For example, if the intraluminal pressure is 22 and the surrounding pressure is -10, then the transmural pressure is 22-(-10) = 32. This increased transmural pressure decreases the intraluminal pressure, dilates the blood vessels, and increases blood flow into the pulmonary blood vessels (Berryhill, Benumof, & Rauscher, 1978). The reduced pulmonary vascular pressure results in venous pooling in the pulmonary vessels and transient reduction in the blood delivery to the left side of the heart, which reduces the left ventricular filling (preload). Decreased intrathoracic pressure also increases the transmural pressure of the heart, thus increasing venous return to the right atrium (Sulzbach, 1988) and increasing right ventricular end diastolic volume. The increase in the right ventricular end diastolic volume displaces the interventricular septum into the left ventricle and further decreases the filling capacity of the left ventricle (Cosio, Martinez, Serrano, de la Calada, & Alcaine, 1977; Kasper, 2005). As a result of these factors, the stroke volume decreases and systolic blood pressure falls (Sulzbach, 1988; Urden, Stacy, & Lough, 2006; Woods, Froelicker, Motzer, & Bridges, 2005).

During expiration, the intrathoracic pressure increases, which decreases the transmural pressure of the pulmonary blood vessels. For example, if the intraluminal pressure is 22, but the surrounding pressure is +10, the transmural pressure will be 22(+10) =12. The decreased transmural pressure increases the intraluminal pressure, which “pushes” the blood from pulmonary vessels into the left ventricle and increases left ventricular preload. Therefore, stroke volume and systolic blood pressure increase. These cyclic changes in systolic pressure of pulsus paradoxus can be observed by continuous intra-arterial pressure monitoring (See Figure One).

Pulsus paradoxus in mechanical ventilation
In a mechanically ventilated patient, some ventilation modes, such as assist control, pressure control, or high levels of pressure support change the intrathoracic pressure during the

Figure One. Pulsus paradoxus with spontaneous breathing.
These pressure tracings were recorded from a patient with a pulmonary embolism. He was breathing spontaneously and the intra-arterial line tracing shows a pulsus paradoxus. The systolic blood pressure difference between inspiration (112 mmHg) and expiration (157 mmHg) is 45 mmHg.

Figure Two. Pulsus paradoxus with mechanical ventilation.
These pressure tracings were recorded from a patient on mechanical ventilation (assist control mode), who developed pulsus paradoxus due to status asthmaticus. The systolic blood pressure difference between inspiration (140 mmHg) and expiration (117 mmHg) is 23 mmHg.
respiratory cycle, making them reversed. During inspiration, intrathoracic pressure increases, which reduces the pulmonary vascular transmural pressure, which “pushes” pulmonary blood into the left ventricle and increases the left ventricular preload. As a result, both stroke volume and systolic pressure increase. During expiration, intrathoracic pressure decreases (decrease in pushing force) causing a slower return of pulmonary blood into the left ventricle. This leads to the decreases in left ventricular preload, stroke volume, and systolic pressure (see Figure Two).

The changes in pulmonary vascular pressure and arterial pressure during inspiration and expiration, either in a spontaneously breathing or a mechanically ventilated patient, can be monitored by the simultaneous monitoring of pulmonary artery pressure and arterial pressure. Below is a case study depicting a patient who was mechanically ventilated and experiencing a pulsus paradoxus.

Case study

J.S., a 65-year-old female, was admitted to the critical care unit with multiple trauma after being in a motor vehicle collision. An oral endotracheal tube was inserted in the emergency room and J.S. was put on assist-control mode of ventilation. Her admission vital signs were BP 108/64, pulse 88, respiratory rate 18, and SpO2 95%. An intra-arterial line and a pulmonary artery catheter were inserted. J.S.’s nurse noticed that she had a pulsus paradoxus with a systolic blood pressure difference of 42 mmHg between inspiration and expiration (see Figure Three). After admission, J.S.’s peak airway pressure increased from 16 cmH2O to 29 cmH2O. A repeat chest x-ray indicated that J.S. had developed a right pneumothorax. A chest tube was inserted and J.S.’s peak airway pressure returned to 18 cmH2O and the pulsus paradoxus resolved.

Conclusion

As a critical care nurse, it is essential to understand the underlying pathophysiology of our patients’ conditions and to interpret assessment data correctly, such as pulsus paradoxus. Pulsus paradoxus is a sign that indicates the patient has developed severe dysfunction or a life-threatening condition. Identifying the cause of pulsus paradoxus and implementing appropriate interventions according to the patient’s problem should resolve pulsus paradoxus and prevent further complications.

Figure Three. J.S.’s pressure tracings before intervention. These pressure tracings were recorded after the insertion of an intra-arterial line and pulmonary artery catheter. The systolic blood pressure difference between inspiration (126 mmHg) and expiration (84 mmHg) is 42 mmHg.
Predicting episodes of hypotension by continuous blood volume monitoring among critically ill patients in acute renal failure on intermittent hemodialysis

By Teddie Annette Tanguay, MN, Louise Jensen, PhD, and Curt Johnston, MD, FRCPC

Research support: Gambro Canada, Canadian Association of Critical Care Nurses

Key words: acute renal failure, intermittent hemodialysis, blood volume monitoring, critically ill

Abstract

Background: Acute renal failure (ARF) develops in 23% of all critically ill patients. Hypotension occurs in 25% to 50% of patients during intermittent hemodialysis (IHD) for ARF. Blood volume (BV) monitoring has been used in chronic renal failure, with limited use in ARF during IHD. Continuous BV monitoring in the stable critically ill patient with ARF could predict, and possibly prevent, development of hypotensive episodes.

Methods: This prospective observational study examined the relationship of BV and BV slopes to hypotension in 11 critically ill adults with ARF over three consecutive IHD Runs. The hypothesis was that there is a patient-specific critical BV and/or a specific BV slope that indicates forthcoming hypotension.

Results: The incidence of hypotension, according to mean arterial pressure < 70 mmHg, was 70%. No relationship was found between BV and blood pressure, and occurrence of hypotension in critically ill patients with ARF on IHD.

Conclusion: Monitoring BV was not shown to predict hypotension in this cohort dialyzed via central venous catheters.

Critically ill patients are at high risk (23%) of developing acute renal failure (ARF) secondary to their presenting problem of shock, trauma or vascular disease (Lameire & Vanholder, 2000; Mehta, 1994). Critically ill patients who develop ARF have a 35% to 50% increase in mortality (Lameire, Van Biesen, Vanholder, & Colardijn, 1998). One treatment modality for ARF in the critically ill patient has been intermittent hemodialysis (IHD); however, a major complication of IHD is hypotension (Conger, 1998).

Hypotension occurs in approximately 50% of critically ill patients with ARF on IHD (Mehta, 1994). The occurrence of dialysis-induced hypotension may be multifactorial. Changes in plasma osmolality, autonomic neuropathy, and loss of vasoactive substances such as catecholamines are associated with dialysis-induced hypotension. The ultrafiltration rate (UFR) is a major factor in dialysis-induced hypotension. The inability of the body to equal the UFR with fluid obtained by plasma refill leads to decreased intravascular volume causing hypotension (Sturniolo, Costanzi, Ruffini, Passalaqua, Fulignati, & Splendiani, 1990). Thus, Lopot, Kotyk, Blaha, and Forejt (1996) described a continuous blood volume (BV) monitoring technique that could be used to detect the risk of hypotension. Theoretically, by monitoring BV, one should be able to predict episodes of hypotension.

Research to date supports the benefit of continuous BV monitoring in the chronic renal failure (CRF) patient (deVries et al., 1993; deVries, Donker, & deVries, 1994; Steuer, Harris, & Conis, 1993), especially in the hypertensive prone patient (Donauer, Kolbin, Bek, Krause, & Bohler, 2000; Steuer, Leyboldt, Cheung, Harris, & Conis, 1994). Donauer et al. (2000) also indicated that BV monitoring was only effective in predicting hypotension in patients with hypovolemic hypotension (Type 1) and not with patients with hypotension caused by cardiovascular dysfunction (Type 2). Recent research indicates that the patient’s critical BV threshold, the specific value whereby hypotension occurs, must be determined for the patient to benefit from BV monitoring in the prevention of dialysis-induced hypotension (Howard, Palmer, Howard, Goldberger, & Shabshab, 1998; Steuer, Leyboldt, Cheung, Harris, & Conis, 1994; Steuer, Leyboldt, Cheung, Senekjian, & Conis, 1996). However, the use of BV monitoring has not been studied as intensely in the critically ill patient with ARF requiring IHD. Critically ill patients with ARF are frequently catabolic, hemodynamically unstable, and often have substantial fluid volume excess (Paganini, Sandy, Moreno, Kozlowski, & Sakai, 1996). In addition to their underlying disease, they frequently have compromised cardiovascular compensatory mechanisms (Paganini et al., 1996). They require efficient
and carefully planned hemodialysis to provide optimal renal support (Conger, 1998). The need for stable dialysis in the critically ill patient with ARF has been emphasized, as dialysis-induced hypotension may be responsible for prolongation of ARF by potentially re-insulting the kidneys (Conger, 1998). However, Tonelli, Astephen, Andreou, Beed, Lundrigan, and Jindal (2002) were unable to predict hypotensive episodes in the critically ill patient in ARF on IHD. So, the question remains as to whether continuous BV monitoring in the stable critically ill patient with ARF can predict hypotensive episodes. If this relationship exists, monitoring BV and BV slopes could possibly prevent development of hypotensive episodes in the critically ill ARF patient.

**Purpose**
The purpose of this study was to examine the relationship of BV and BV slopes to hypotension in the critically ill ARF adult patient on IHD admitted to a general systems intensive care unit (GSICU). The hypothesis was that there is a patient-specific critical BV and/or a specific BV slope that indicates forthcoming hypotension.

**Methods**

**Design.** A prospective observational design (within subject repeated measures) of 11 patients for a total of 33 IHD runs was used to examine the relationship of BV and BV slopes to the development of hypotension in the critically ill ARF patient on IHD. BV, heart rate (HR), systolic blood pressure (SBP), and mean arterial pressure (MAP) were obtained every 15 minutes for three consecutive dialysis sessions occurring either daily or every second day. The length of the dialysis was determined by the intensivist based on an estimation of the amount of time required for adequate clearance of uremic toxins and safe removal of fluid in order to avoid hypotension. The length of IHD Run ranged from four to seven hours and varied between the IHD runs, with six hours being the most common. The UFR and dialysate osmolality (sodium concentration of dialysate bath was set at 140) were constant throughout the IHD run. The dialysate flow rate was 500 mls for all patients. The dialysate temperature was maintained at the current standard of 37 degrees Celsius or one degree cooler than the patient’s body temperature. All IHD runs were done through a dual lumen central venous catheter. Ethical approval was obtained for conduct of the study.

**Sample.** The sample consisted of hemodynamically stable critically ill patients > 18 years of age with ARF. Patients were excluded if they were on IHD for isolated hyperkalemia not caused by ARF, on IHD for drug overdose, on IHD with a diagnosis of chronic renal failure, or receiving blood transfusions during IHD. There were 59 patients admitted to GSICU during the 10-month data collection period who required IHD. Of these 59 patients, 44 patients did not meet the inclusion criteria, and 15 patients provided informed consent and were enrolled in the study. Analysis was completed on 11 patients, as one patient withdrew consent and three patients had ARF resolve prior to completion of data collection.

**Definition of variables.** Hypotension, BV slope, and critical BV were defined as follows:

*Hypotensive episode* was a SBP < 90 mmHg or a decrease of ≥ 30 mmHg and/or a MAP < 70 mmHg (Sturniolo et al., 1990; Tonelli et al., 2002). Hemodynamically unstable

### Table One: Patient characteristics (n=11)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency</th>
<th>(%)</th>
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<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>2</td>
<td>(18.2)</td>
</tr>
<tr>
<td>31-50</td>
<td>2</td>
<td>(18.2)</td>
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<tr>
<td>51-70</td>
<td>5</td>
<td>(45.5)</td>
</tr>
<tr>
<td>71-90</td>
<td>2</td>
<td>(18.2)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>(63.6)</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>(36.3)</td>
</tr>
<tr>
<td><strong>Admission Diagnosis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory Failure</td>
<td>4</td>
<td>(36.4)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>2</td>
<td>(18.2)</td>
</tr>
<tr>
<td>Trauma</td>
<td>1</td>
<td>(9.1)</td>
</tr>
<tr>
<td>Abdominal Surgery</td>
<td>3</td>
<td>(27.3)</td>
</tr>
<tr>
<td>Cardiac Disease</td>
<td>1</td>
<td>(9.1)</td>
</tr>
<tr>
<td><strong>Admission Apache II Scores</strong></td>
<td></td>
<td></td>
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<tr>
<td>1-20</td>
<td>4</td>
<td>(36.4)</td>
</tr>
<tr>
<td>21-30</td>
<td>5</td>
<td>(45.5)</td>
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<tr>
<td>&gt;30</td>
<td>2</td>
<td>(18.2)</td>
</tr>
<tr>
<td><strong>Comorbidities</strong></td>
<td></td>
<td></td>
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<tr>
<td>Diabetes Mellitus</td>
<td>1</td>
<td>(9.1)</td>
</tr>
<tr>
<td>Cancer</td>
<td>2</td>
<td>(18.2)</td>
</tr>
<tr>
<td>Cancer &amp; HTN*</td>
<td>1</td>
<td>(9.1)</td>
</tr>
<tr>
<td>Vasculitis</td>
<td>2</td>
<td>(18.2)</td>
</tr>
<tr>
<td>Renal Insufficiency, CAD* &amp; Diabetes Mellitus</td>
<td>3</td>
<td>(27.3)</td>
</tr>
<tr>
<td>Psychiatric</td>
<td>1</td>
<td>(9.1)</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
<td>(9.1)</td>
</tr>
<tr>
<td><strong>Etiology of Renal Failure</strong></td>
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<td></td>
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<tr>
<td>Rhabdomyolysis</td>
<td>3</td>
<td>(27.3)</td>
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<tr>
<td>Acute Tubular Neurosis</td>
<td>5</td>
<td>(45.4)</td>
</tr>
<tr>
<td>Vasculitis</td>
<td>1</td>
<td>(9.1)</td>
</tr>
<tr>
<td>Acute on Chronic Renal Failure</td>
<td>2</td>
<td>(18.2)</td>
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<tr>
<td><strong>Previous Dialysis Treatment</strong></td>
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<tr>
<td>IHD*</td>
<td>4</td>
<td>(36.4)</td>
</tr>
<tr>
<td>CRRT*</td>
<td>5</td>
<td>(45.5)</td>
</tr>
<tr>
<td>IHD/CRRT*</td>
<td>2</td>
<td>(18.2)</td>
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<tr>
<td><strong>Body Mass Index</strong></td>
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<td></td>
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<tr>
<td>20-30</td>
<td>6</td>
<td>(54.4)</td>
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<td>31-40</td>
<td>3</td>
<td>(27.3)</td>
</tr>
<tr>
<td>41-50</td>
<td>2</td>
<td>(18.2)</td>
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</tbody>
</table>

* CAD = Coronary Artery Disease, HTN = Hypertension, IHD = Intermittent Hemodialysis, CRRT = Continuous Renal Replacement Therapy
patients who required initiation of vasopressors or titration of vasopressors to maintain a SBP ≥ 90 mmHg were identified as having a hypotensive episode. The BP had to return to normal for greater than five minutes to be considered a new hypotensive episode. BP and/or MAP was measured by arterial line or BP cuff and documented on the patient’s hemodialysis log. BV was monitored continuously by an optical reflection method on the Integra dialysis machine (Hemoscanning). BV was obtained at 15-minute intervals, and prior to hypotension, for each dialysis session.

**BV slope** is a tracing of BV over time during the IHD run. BV slope was obtained from a graph generated by continuous BV monitoring on the Integra dialysis machine. BV slopes can be flat, linear decrease, concave upward increase, or concave downward decrease (Andrulli, Colzani, Mascia, Lucchi, Stipi, Bigi, et al., 2002). The BV slope for each IHD run was classified independently by two raters.

**Critical BV** is the decrease of BV below a specific value whereby hypotension occurs. To obtain the critical BV, the BV at each hypotensive episode during the three IHD runs was averaged to obtain the critical BV for that patient (Begin, Deziel, & Madore, 2002).

**Data analysis.** Descriptive statistics were conducted for all variables. Critical BV was calculated by averaging the BV prior to each hypotensive episode during the three IHD runs. Inter-rater reliability of BV slope classification was assessed using a Kappa statistic. Frequency of hypotensive episodes was calculated per BV slope classification. The relationship between BV and BP (MAP and SBP) was examined using linear regression analysis, and Chi-square analysis was done to examine the relationship of BV slope to frequency of hypotensive episodes.

**Findings**

Analysis was completed on 11 patients for a total of 33 IHD runs. The mean age of the patients was 55.73 ± 20.6 years, with a range of 19 to 87 years. The most frequent admitting diagnosis was respiratory failure (36.4%), and the most frequent comorbidity was a combination of renal insufficiency, coronary artery disease, and diabetes mellitus (27.3%). The mean Apache II Score was 22.73 ± 6.69, with a range of 13 to 33. The most common etiology of ARF was acute tubular necrosis due to shock (45.5%), followed by rhabdomyolysis (27.3%). All patients received some form of hemodialysis prior to enrollment in the study, the most common being continuous renal replacement therapy (CRRT) (45.5%) (Table One).

The overall incidence of hypotension according to MAP was 70%, and according to SBP was 34%. The frequency of hypotensive episodes by MAP in both IHD run one and IHD run three was 63.6%, and 81.8% in IHD run two; by SBP was 36.4% in IHD run one, 72.7% in IHD run two, and 27.3% in IHD run three. Although the frequency of hypotension by MAP was high, no treatment occurred in 63.6% of the hypotensive episodes in IHD run one and IHD run two, and in 72.7% in IHD run three. The mean heart rate ranged from 87.91 ± 16.54 beats per minute (BPM) pre-IHD run one to 81.82 ± 13.71 BPM pre-IHD run three. The mean heart rate at completion of the IHD runs was comparable, with a mean of 90.36 ± 18.09 BPM post IHD run one to 86 ± 14.92 BPM post-IHD run three.

The BV slope for each IHD run was classified independently by two raters. Inter-rater agreement for IHD run one was k=0.554, for IHD run two was k=0.033, and for IHD run three was k=0.542. The overall percentage agreement between the raters was 51% (17 out of 33). The most frequent BV slope was linear decrease, with a rate of 63.6% in IHD run one, 45.5% in IHD run two, and 54.5% in IHD run three. The next most common BV slope was concave upwards decrease at 9.1% in IHD run one, and 27.35% in both IHD run two and IHD run three; followed by flat at 27.3% in IHD run two, and 9.15% in both IHD run one and IHD run three. Concave downwards decrease occurred only once in IHD run three. There was no significant relationship found between BV slope and hypotensive episodes per IHD run in this cohort.
Linear regression was done to determine if there was a relationship between blood volume and blood pressure during IHD runs. With the dependent variable as MAP, and the independent variable as BV, there was a correlation of 0.075, accounting for 0.60% of the variance (p=0.70) (Figure One). With the dependent variable as SBP, and the independent variable as BV, there was a correlation of 0.327, accounting for 11% of the variance (p=0.08) (Figure Two). Thus, BV did not predict BP in this cohort.

The critical blood volume (CBV) was calculated for 10 patients who experienced hypotension. A linear regression was also done to determine the relationship of CBV and blood pressure. With the dependent variable MAP, and independent variable BV, there was a correlation of 0.144, accounting for 2.10% of the variance (p=0.083) (Figure Three). With SBP as the dependent variable and BV as the independent variable, there was a correlation of 0.151, accounting for 2.30% of the variance (p=0.068) (Figure Four). Thus, a CBV was not determined to be predictive of hypotension.

**Discussion**

**Hypotension.** Ten of the 11 patients experienced hypotension during hemodialysis. The incidence of hypotension over all three IHD runs according to MAP <70 mmHg was 70%, higher than the 30% reported by Tonelli et al. (2002). The incidence of hypotension according to SBP <90 mmHg was 45% over all three IHD runs, also higher than the 18% reported by Tonelli et al. (2002). This is an interesting finding as the average length of dialysis run in this study was longer than most. Therefore, we would have expected the frequency of hypotensive episodes to be lower. Studies with IHD runs >4 hours have shown a decreased frequency of hypotension in ARF patients on dialysis in GSICU (Kumar, Craig, Depner, & Yeun, 2000). It is possible that the small sample size contributed to our finding. Treatment for hypotension is directed by SBP guidelines in our GSICU. Therefore, the treatment for hypotension was similar to the frequency of hypotension by SBP. In IHD run one and IHD run two, treatment occurred 36.4% of the time, respectively. In IHD run three, treatment for hypotension occurred 27.3% of the time. The overall percentage of treatment for all three IHD runs was 33%. This is lower than the occurrence for hypotension defined by both SBP <90 mmHg and MAP <70 mmHg. There is no consistent definition for hypotension in the ARF patient, thus degree of hypotension that affects recovery in the ARF patient needs to be determined.

**Blood volume slopes.** The most frequent BV slope was linear decrease for all IHD runs, thus it was also the most frequent BV slope occurring with hypotension. These findings differ from Andrulli et al.’s (2002), who found linear decrease to be the most common in patients who were normotensive, and concave upwards decrease to be the most common BV slope in hypotensive patients. There was no relationship found between BV slope and occurrence of hypotension in our cohort. Low inter-rater agreement for BV slope classification in all IHD runs may account for this finding.

**Relationship of blood volume to blood pressure.** BV was obtained at 15-minute intervals, and prior to hypotension, for each IHD run. BV monitoring devices depend on the fact that the blood components are confined to the vascular space enabling the measurement of relative blood volume. Therefore, as plasma water was removed by UF, the concentration of the blood compartment increased hematocrit (HCT) levels and there was a proportional decrease in circulating BV (Chamney et al., 1999). As expected, there was a decrease in BV as ultrafiltration occurred. Although there was a correlation between MAP, SBP and BV, this relationship was not significant. These findings were similar to Tonelli et al. (2002), who also found monitoring of BV could not predict episodes of forthcoming hypotension.
Several factors may contribute to the inability of BV to predict forthcoming hypotension. Although hypovolemia contributes to hypotension in critically ill patients on IHD, there are other contributing factors as well. Other mechanisms such as autonomic dysfunction and abnormal vascular tone may affect plasma refill in the critically ill patient affecting the ability of BV monitoring to predict hypotension. We did not measure plasma refill with bioimpedance, which may have clarified whether abnormal vascular tone was contributing to abnormal plasma refill in the critically ill patient. Critical blood volume was calculated for all patients who experienced hypotension, however, we were unable to find a CBV for individual patients that could predict forthcoming hypotension. This may indicate that hypotension is more dependent on cardiovascular defense mechanisms such as sympathetic drive rather than on reduction in BV. Thus, CBV would not be able to consistently predict forthcoming hypotension, if hypotension is dependent on more than BV.

All patients were dialyzed through central venous catheters. It has been suggested that there is a difference in hematocrit levels between central blood and peripheral blood compartments (Tonelli et al., 2002; Prakash, Reddan, Heidenheim, Kianfar, & Lindsay, 2002), which, in turn, may affect the correlation of BV to hypotension. Another interesting element that was noted in this study was the high number of interdialytic alarms related to access pressures. This necessitates the blood pump speed be changed, which affects

the accuracy of BV monitoring. Any time blood pump speeds are adjusted, BV monitoring needs to be recalibrated and does not resume until the pump speed is > 200 for five minutes. This may have affected the reliability of the monitoring device.

**Limitations**

The small sample size may have accounted for an inability to show a statistically significant relationship between BV and hypotension. The physicians and nurses in the GSICU were aware that hypotension in IHD was being evaluated, which could have led to modifications in treatment of patients on IHD. However, dialytic technique was standardized as much as possible during this study. The length of IHD runs and ultrafiltration removal rates varied between patients. However, this is usual in critical care practice when BV monitoring would be used. In this study, both arterial lines and automated sphygmomanometers were used to measure blood pressure, which may have introduced measurement error. In our cohort, all IHD runs were done via central venous catheters, as well, there were frequent access alarms that may have affected the reliability of the BV monitoring device. This may have accounted for our inability to determine a relationship between BV and hypotension in critically ill ARF patients in IHD. There is a need for further study to determine if a different monitoring device designed for use with central venous access could be used to predict hypotension.
Conclusions
Hypotension occurred in approximately 70% of all IHD runs for this cohort of critically ill ARF patients. Monitoring of BV was not shown to predict episodes of forthcoming hypotension. However, this does not preclude the need to implement strategies to reduce hypotension during dialysis. The multifactorial etiology of hypotension in ARF patients on IHD indicates that one simple strategy is unlikely to alleviate this problem. A group of critically ill patients who are older, have higher Apache scores, and have multiple comorbidities such as cardiac disease and diabetes mellitus with reduced cardiovascular defence mechanisms may be unable to compensate for a reduction in BV in order to prevent hypotension. This subgroup may benefit from less aggressive dialysis treatment strategies.

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References

The Canadian ICU Collaborative: On being a nurse champion. Influencing support and change

By Tracie Northway, RN, MSN, CNCCP(C), and Cathy Mawdsley, RN, MScN, CNCC(C)

It may seem a strange principle to enunciate as the very first requirement in a hospital that it should do the sick no harm (Florence Nightingale as cited in Johnson, 2003).

Historically, nurses have experienced distress at being unable to deliver holistic care. In the critical care environment, this struggle has been explored from the coffee room to the ivory towers of academia (Elpern, 2005; Kelly, 2004; Shalof, 2005; Storch, 2002; Wheelan, Burchill, & Tilin, 2003; Wlody, 2007). The lived reality of feeling conflicted in our role as “mini-doctors” versus nurses in a critical care environment has impacted the quality of nursing care (Kelly, 2004). Our need to tend to machines caring for patients often over-rides or impedes our ability to provide basic nursing care. Whether there is an increase, or we are just more aware, the sequelae our patients receive as a result of our treatment can be as catastrophic as their reason for admission. For many of us, we are just beginning to understand the extent of patient morbidity resulting from stays in the intensive care environment (Needham et al., 2005). There is evidence to say we can do better and, currently, many intensive care units (ICUs) are seeing successes in attempting to do just that (Berenholtz et al., 2004; Knapp, 2006; Nguyen et al., 2007; Winters, Pham, Hunt, Guallar, Berenholtz, & Pronovost, 2007). The patient safety movement has provided the vehicle for health care teams to be supported in their efforts to provide safe quality care (Hospital Infection Control, 2007). Perhaps one of the most exciting aspects of being involved in the Canadian ICU Collaborative is seeing the opportunities it offers for those who administer care to influence change. This column will focus on the experiences of two ICU nurses as nurse champions for patient safety within the Canadian ICU Collaborative.

What is the role of a “nurse champion”? The concept of “champions” or “change agents” is prevalent within change theory literature (Adler, Riley, Kwon, Signer, Lee, & Satrasala, 2003; Bellanca, 2007; Reinertsen, Gosfield, Rupp, & Whittington, 2007; Smith, 2003). Six Sigma (2003), an improvement group within business communities, emphasizes that change agents must have the ability to state facts based on data even if it meets resistance from colleagues. Within the Canadian ICU Collaborative the role of the safety champion pertains to any member of the health care team who is respected by his/her peers (social skills and clinically sound) and has a willingness and desire (courage) to move towards improving patient outcomes. The Institute for Healthcare Improvement asserts that a strong champion need not be a structural leader in order to make a critical difference in many clinical projects (Reinertsen et al., 2007).

Nurse champions are primarily responsible for working with their unit’s improvement group to support the unit’s change initiative among their nursing and non-nursing colleagues. The nurse champion must be comfortable in formulating responses to naysayers that are respectful, but challenge the negativity often associated with a move towards change. The improvement team must be prepared to support their nurse champion(s) as they often bear the brunt of any resistance due to their positioning within the staff.

The role of the nurse champion is not always battling the odds. It is considered by many who have assumed it to be a superb opportunity to develop professionally. By becoming a nurse champion with the Canadian ICU Collaborative, these nurses are exposed to quality improvement process education, reviews of current best practice and working within a motivated unit-based and national team. The outcome for many of these nurse champions has included an increased comfort in working with projects, increased job satisfaction and stronger team relationships.

Stories from two “nurse champions”

Emma Folz, RN, BScN. Emma was a staff nurse in the pediatric ICU at Toronto’s Hospital for Sick Children when she joined the Canadian ICU Collaborative in the fall of 2004. This was the first time that pediatric ICUs (PICUs) had joined the Collaborative and they had agreed to work collectively on one subject, the reduction of catheter-related blood stream infections.

Emma was the first nurse champion identified within the PICU collaborative stream. Her position was created at the insistence of her unit’s medical director who believed the project required a designated person to lead the project and “make it real” for the staff. She was the nurse chosen by unit leaders who nominated various staff members for this role.

To hear Emma tell her story, it is one of growth and celebration. She speaks of her journey as nurse champion on this initiative with excitement and pride. Emma began the work with the improvement team with little experience in quality improvement and leading groups. She states she found the beginning to be challenging for those reasons and the fact...
that her role evolved into a day-a-week for management of the improvement initiative. Emma describes her duties as those of a coordinator for the improvement process. She was present in the unit to ensure the different cycles were rolled out and supported staff through the testing and changes. She communicated via 1:1 conversations, website postings, notices, presentations with the physician and nursing groups about the purpose of the project and any changes and their outcomes. This communication was time consuming, but Emma describes it as rewarding because she developed relationships at a different level with nurses and physicians and was able to better understand barriers through someone else’s eyes.

Emma believes that she has grown professionally through this opportunity. From it, she cites developing stronger leadership skills (e.g., time management, organization, group management, communication and conflict resolution skills). In her 11 months in the role, Emma developed a greater appreciation for the difficulties that occur when communication is not clear between management and staff. Emma believes that projects such as these enable some of the barriers to be broken down as everyone is working towards the same goal and the nurse champion acts as an interpreter between the team (which is often management) and staff. Another benefit that Emma discussed was the national relationship-building that occurred among the participating PICUs. She spoke of being appreciative of the fact that she has developed partnerships with colleagues across Canada, which has enhanced practice nationally. She believes it is the support of her leadership team and the Collaborative that assisted her in her development as a nurse champion.

Emma has since moved from Toronto to Calgary where she is currently a Nurse Educator in the Pediatric Intensive Care Unit at Alberta Children’s Hospital. When asked if she would currently a Nurse Educator in the Pediatric Intensive Care Unit Emma has since moved from Toronto to Calgary where she is emphatically stated “Yes”. This is obvious as Emma is “paying it forward” by bringing new staff nurses to Collaborative learning sessions and supporting them in their roles as nurse champions. The ultimate goal is better patient outcomes through the safe delivery of quality care and the gift is the change in culture and morale associated with staff empowerment.

“"You must be the change you want to see in the world.”
(Mahatma Gandhi, 1869-1948)

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How to become a “Nurse Champion”

- Find out about your unit and hospital’s patient safety and quality improvement initiatives.
- Be curious. Demonstrating curiosity is often associated with a willingness to learn. Ask questions of your unit leaders about how things could be done better within your unit.
- Offer to help with improvement projects implementation.
- Think about some strategies for shifting your unit’s values and beliefs around care delivery and offer those to your unit leaders.
- Be respectful of where your colleagues are positioned. Not everyone embraces change.
- Learn more about quality improvement and patient safety. Check out the websites for the Canadian ICU Collaborative, Safer Healthcare Now! and the Institute for Healthcare Improvement.
Interventions by critical care nurses reduce VAP

By Glenda Roy, RN, BN, MN, CNCC(C), CCN(C)

Abstract
Critically ill patients who have been mechanically ventilated longer than 48 hours are at increased risk for developing ventilator-associated pneumonia, a nosocomial infection that is the leading cause of morbidity and mortality in the intensive care unit. In this article, the care provided by critical care nurses to reduce the risk of this potentially lethal complication is discussed.

Nosocomial pneumonia (NP) was discussed by William Osler at the beginning of the twentieth century when differentiating between community-acquired pneumonia and pneumonias that occurred as a result of a complication (Myrianthefs, Kalafati, Samara, & Baltopoulos, 2004). In the past, NP was called the “old man’s friend” for providing an exit from a difficult life (Myrianthefs et al.), but today it is known as the gorilla within the intensive care unit (ICU) (Baughman, 2003).

The incidence of ventilator-associated pneumonia (VAP) occurring in mechanically ventilated (MV) patients ranges from 4% to 42% with an associated hospital cost of $50,000 U.S. per case (Abbott, Dremsa, Stewart, Mark, & Swift, 2006; Davis, 2006). The outcome of this cohort of patients is significantly influenced by the activities of people who come in contact, directly or indirectly, with them. The critical care nurse is committed to providing a safe environment to promote healing and reducing the incidence of infection and, as such, is well-positioned to reduce the risk of VAP.

An extensive literature review was conducted using the various electronic databases, such as ProQuest Nursing Journals, Sage Publications and Blackwell Synergy at Athabasca University library. English language, full text and articles published within the previous 10 years using the word combinations of “ventilator associated/acquired pneumonia”, “nosocomial pneumonia” and “nursing interventions” were the key elements of this search. Articles were analyzed to determine the pathogenesis of VAP and the evidence-based nursing interventions used to fight the war against VAP. In this article, VAP is discussed together with its pathogenesis and the interventions critical care nurses can employ to decrease the risk of VAP.

What is ventilator-associated pneumonia?
VAP is defined as a new onset, nosocomial bacterial pneumonia among patients who have received MV, either by endotracheal tube (ETT) or tracheostomy, for longer than 48 hours (Mayhall, 2001). Early-onset VAP occurs between 48 and 96 hours post-initiation of MV, and results from community-acquired, antibiotic sensitive bacteria such as Staphylococcus aureus, Haemophilus influenzae, Moraxella catarrhalis and Streptococcus pneumoniae (Myrianthefs et al., 2004). Late-onset VAP occurs after five days of MV, with the pathogens being more multi-drug-resistant (MDR) including gram-negative enterobacteriaceae (60%), Pseudomonas aeruginosa, Acinetobacter species and methicillin-resistant Staphylococcus aureus (Myrianthefs et al.). Although VAP is predominantly a bacterial infection, viruses, molds and fungi may also be the culprits (Davis, 2006).

Diagnosis of VAP
The gold standard test for diagnosing VAP, culture biopsy or autopsy lung specimens is difficult to obtain and impractical, and the clinical criteria for VAP is nonspecific (Fujitani & Yu, 2006). As many as 66% of the patients with a clinical diagnosis of VAP fail to meet the microbiologic criteria for infection (Davis, 2006).

The clinical picture of the patient with VAP may not be conclusive, but the clinical assessment is the cornerstone to the diagnosis of VAP and the initiation of therapy (Myrianthefs et al., 2004). A clinical pulmonary infection score, a weighted scale with high sensitivity and specificity, awards points for fever, leukocyte count, quantity and purulence of secretions, oxygenation, type of radiographic abnormality, and sputum Gram stain results (Davis, 2006). These criteria alert physicians and nurses to the possibility of VAP.

In addition to the clinical assessment, optimal specimen collection and laboratory processing prior to the initiation of antibiotic therapy is recommended (Myrianthefs et al., 2004). The various tests that are valuable in determining the presence of VAP are blood cultures, pleural fluid, tracheal aspirate and other respiratory specimens obtained by bronchoscopy or needle aspiration (Myrianthefs et al.).

The diagnostic method will depend on the local expertise and the method available (Myrianthefs et al., 2004). Quantitative cultures using bronchoalveolar lavage and/or protected-specimen-brush are supported by research as they permit precise identification of the infective VAP organism, which assists in the appropriate antibiotic selection and, thus, improving patient outcomes (Davis, 2006). The use of endotracheal aspirate culture is recommended until other invasive and noninvasive procedures are standardized and validated in clinical trials (Fujitani & Yu, 2006).
Why does VAP occur?
The pathogens gain entry to the sterile environment of the lower respiratory tract by various modes. Some routes of travel include contiguous spread from an adjacent infection, hematogenous spread from a distant focus of infection, inhalation of infectious aerosols, and the most common being aspiration of colonized bacteria from the oropharynx and gastrointestinal tract (Alp & Voss, 2006; Myrianthefs et al., 2004).

Endotracheal intubation bypasses the protection of the nasopharynx, impedes the cough reflex, jeopardizes mucociliary clearance, and injures the tracheal epithelium (Davis, 2006). The presence of the ETT keeps the vocal cords open, facilitating direct entry of pathogens into the lower respiratory tract. The inflated cuff permits the pooling of secretions above the cuff, providing a medium for pathogens to grow (Myrianthefs et al., 2004). The loss of the body’s natural defence mechanisms, critical illness, comorbidities, sedation and malnutrition decrease the body’s ability to fight infection (Davis).

The stomach’s acidic pH halts the colonization of pathogens, but stress ulcer prophylaxis and enteral nutrition create an alkaline environment conducive to the growth of gram-negative organisms (Davis, 2006). Enteral nutrition predisposes the patient to gastroesophageal reflux and aspiration because of gastric distention and impairment of the gastroesophageal sphincter (Alp & Voss, 2006). Microaspiration and colonization of virulent pathogens contribute to the acquisition of VAP (Davis).

Inadequate infection control measures and poor hand hygiene when health care staff is in contact with the patient’s respiratory secretions and equipment increase the risk for acquiring VAP (Pruitt & Jacobs, 2005). The collection of condensate in the ventilatory circuit provides a breeding ground for pathogens. Caring for the patient in the supine position has been shown to increase the risk of VAP due to aspiration of these contaminated secretions (Alp & Voss, 2006). Also, breaching the closed ventilatory circuit is an invitation for pathogens to enter the patient (Mathews & Mathews, 2000).

Who is at risk?
The MV patient’s risk for developing VAP is 3% per day the first week of intubation, and decreasing to 2% and 1% per day for the second and third week respectively (Davis, 2006). The patient population identified as being at increased risk for developing VAP includes those patients with increased risk of aspiration, impaired defence mechanisms, trauma, burn injury, acute lung injury, severity of illness, and male gender (Davis; Myrianthefs et al., 2004; Pruitt & Jacobs, 2005). Prior antibiotic use and the duration of MV are two of the most important risk factors for VAP, with re-intubation increasing the patient’s risk sixfold (Grap & Munro, 1997; Myrianthefs et al.). Additional risk factors include advanced age, obesity, chronic cardiac and pulmonary disease, malignancy, renal disease, diabetes mellitus, head injury, tracheostomy, nasogastric tube use, recent abdominal surgery, paralytics, and corticosteroid use (Mehta & Niederman, 2003; Myrianthefs et al.).

Prognosis
Patients who have acquired late-onset VAP associated with MDR and fungal infections have a higher mortality rate associated with increased age, complexity of the comorbid diagnoses and severity of the pneumonia (Myrianthefs et al., 2004). Experts estimate 20% to 70% of patients diagnosed with VAP will succumb to this potentially lethal complication (Cason, Tyner, Saunders, & Broome, 2007), with some stating the mortality rate can be as high as 88% (Mehta & Niederman, 2003).

Nursing interventions
Research data provide the evidence required by nurses as they make decisions and adopt interventions for evidence-based patient care. Practice changes are implemented following data review and synthesis of the research findings (Oermann, 2002).

Prevention of VAP should be the number one goal in caring for MV patients. VAP increases mortality, morbidity, length of MV and hospital stay (Davis, 2006). Interventions to reduce and eliminate VAP should be mandated for all MV patients.

Nurses are pivotal in decreasing the patient’s risk for developing VAP. Florence Nightingale, more than 140 years ago, discussed how nursing is limited to administration of medications and treatments, but that they must go beyond this and place the patient in the best condition for nature to heal them (Vollman, 2006). At present, the nurse is consumed with documentation, learning new procedures, technology and the constant changes in the delivery of care, leaving little time to provide the basic nursing care to the acutely ill patient (Shinn, 2004). Nurses can place the patient in the best possible environment, as suggested by Nightingale, by employing timely interventions, protocols and strategies to decrease the risk of microaspiration and the growth of pathogens (Fox, 2006; Shinn).

A significant relationship has been found between elevating the head of bed (HOB) 30 to 45 degrees and the decrease in the incidence of VAP (Tolentino-DelosReyes, Ruppert, & Shiao, 2007). Also, supine positioning increases the risk of reflux, aspiration and decreases functional residual capacity and the immobility impairs mucociliary clearance (Davis, 2006; Shinn, 2004). Critically ill patients must continue to be turned every two hours, which has been established as the standard of care (Goldhill, Imhoff, McLean, & Waldmann, 2007), and positioned with the HOB elevated. To encourage nurses to elevate the HOB in medically stable patients, signage placed in strategic locations is a constant reminder.
However, patients with a contraindication to hip flexion may be placed in the reverse Trendelenburg (Shinn, 2004). J. Baird (personal communication, January 25, 2007) stated “HOB elevation is not done because nurses forget to do so after providing nursing care” or “patient looks more comfortable lying supine or slightly elevated.” Prior to moving or turning the patient, draining the ventilatory tubes decreases the risk of fluid aspiration and inhalation of virulent pathogens (Mathews & Mathews, 2000).

Hand hygiene is an intervention that is easily performed, but poorly executed (Ferrer & Artigas, 2001). Grap and Munro (1997) noted that only 41% of health care workers washed their hands following patient contact, with nurses failing miserably at 22%, after reporting compliance at 90%.

Alcohol is the gold standard in the prevention of infection (Storr & Clayton-Kent, 2004). Regular hand washing with an alcohol-based solution before and after patient contact is recommended and has proven to decrease bacterial counts (Tolentino-DelosReyes et al., 2007). Hand washing is so important that nurses and family members should be encouraged to ask those providing care “Have you washed your hands?”

Glove use is an adjunct to hand hygiene and should be used with each chance of handling contaminated secretions or body fluid and changed between patients. Hand washing or decontamination should be done before and after glove use and between patients (Cason et al., 2007; Johnson, 2006).

Nurses should remove jewelry prior to hand hygiene and administering patient care as rings, bangles and wristwatches have been shown to harbour pathogens and impede efficacious cleansing (Alp & Voss, 2006; Tolentino-DelosReyes et al., 2007). Also, the area under artificial nails has been shown to have higher microbial counts than under natural nails, both before and after hand washing, therefore, patients are at an increased risk of contracting infection from personnel wearing artificial nails (Ogg & Petersen, 2007). Reducing the risk of infection and providing a safe environment to heal is a priority and should take precedence over current trend-setting fashions (Ogg & Petersen).

One of the very basic nursing care elements is to provide oral care to the MV patient who is unable to do his/her own care. The oropharyngeal flora of the critically ill patient changes within 48 hours to virulent, predominately gram-negative bacteria predisposing the patient to VAP (Shinn, 2004) and these patients are already immunocompromised due to their critical illness (Munro & Grap, 2004). Dental plaque also colonizes harmful pathogens; therefore, brushing the patient’s teeth and tongue should be considered basic nursing care (Shinn). Oral care should be carried out every two hours with teeth brushing every 12 hours (Simmons-Trau, Cenek, Counterman, Hockenbury, & Litwiller, 2004).

Implementation

Education, meticulous infection control, hand hygiene and adequate staffing are crucial to the prevention of VAP. Education may be done at nursing rounds and/or on a one-on-one basis with an emphasis on infection control and VAP prevention measures (Craven, 2006). Nurses educated about VAP and its prevention exhibit greater adherence to best practice guidelines (Fox, 2006). Adequate staff, although not always possible, is paramount to ensure the execution of essential infection control practices and other strategies to reduce the risk of VAP (Craven). Easy access to hand washing facilities, decrease in workload, communication, education tools and timely feedback will enhance compliance and reduce cross-contamination, thus improving patient outcomes (Alp & Voss, 2006).
Reducing VAP: The positive outcomes
Reducing the incidence of VAP improves patient outcome, decreases cost of health care associated with length of hospital stay and medication, and expedites patient transfer out of the ICU, enabling other critically ill patients to be admitted to the ICU to receive optimal care (Fox, 2006).

Conclusion
VAP is the leading cause of mortality and morbidity in the ICU and nurses can be instrumental in eradicating this potentially lethal complication. Nurses must be vigilant in executing the interventions that research has shown to be effective in reducing the risk for acquiring this potential lethal complication of mechanical ventilation and ensuring a safe environment for the critically ill patient to heal. Basic nursing care, with the integration of these stringent infection control measures, can greatly reduce VAP and place this gorilla on the endangered species list.

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References
Continuing education (CE) hours from this article will be granted by CACCN. The CE hours can be applied to recertification in the critical care specialty [CNCC(C)] as designated by the Canadian Nurses Association certification program.

Quiz topic: Interventions by critical care nurses reduce VAP

Educational objectives:
Based on the content of the article, you should be able to: 1. Define VAP, distinguishing between early and late onset, 2. Describe the pathophysiology of VAP, 3. Describe at least three nursing interventions that can be implemented to reduce VAP, 4. Identify the benefits in reducing VAP.

Instructions:
To receive CE hours for this quiz, mark your answers on the enrolment form. Complete the form and submit it to CACCN, P.O. Box 25322, London, Ontario, N6C 6B1. Non-members must also include a $12.00 processing fee. This enrolment form must be postmarked by October 1, 2008. Three weeks after the enrolment form and payment are received by CACCN, a corrected answer form will be sent to you. If you receive a passing score, a CE hour certificate will be enclosed.

Quiz Writers: G. Roy, RN, BN, CNCC(C), CCN(C)

Credit: You can earn 1.0 CE hours with a passing mark of 15/16 (94 per cent) correct answers on this quiz (ID #CACCN 07-2).

Questions

1. What is the estimated cost to the health care system for each case of VAP?
   A. 20,000$ U.S.
   B. 30,000$ U.S.
   C. 40,000$ U.S.
   D. 50,000$ U.S.

2. What is the incidence of ventilated patients who develop VAP?
   A. 10% to 25%
   B. 2% to 15%
   C. 7% to 50%
   D. 4% to 42%

3. Early onset VAP occurs in which length of time?
   A. 6 to 24 hours
   B. 24 to 48 hours
   C. 48 to 96 hours
   D. 36 to 52 hours

4. VAP can be caused by which organisms?
   A. bacteria
   B. fungus and molds
   C. virus
   D. all of the above

5. Which of the following contribute to the acquisition of VAP?
   A. poor infection control techniques of health care providers
   B. supine position and microaspiration
   C. endotracheal intubation
   D. all of the above

6. True or false: Stress ulcer prophylaxis is VAP protective?
   A. true
   B. false

7. Which of the following are included in hand hygiene?
   A. regular hand washing before and after patient care
   B. glove wearing
   C. wearing jewelry to work and not removing to do patient care
   D. all of the above

8. True or false: Oral care is not important in reducing VAP?
   A. true
   B. false

9. Which of the following group of patients is at an increased risk to acquire VAP?
   A. patients with chronic cardiac and pulmonary disease
   B. patients with decreased level of consciousness
   C. patients who are immune compromised
   D. all of the above

10. The following are components of the clinical pulmonary infection score that alert physicians and nurses to the possibility of VAP:
    A. new onset fever
    B. new infiltrates on the chest x-ray
    C. purulent secretions
    D. all of the above

11. The gold standard for diagnosing VAP includes the following?
    A. culture biopsy lung specimens
    B. blood cultures
    C. autopsy lung specimens
    D. A & C

12. Identify the two most important risk factors for VAP
    A. elderly and female
    B. heart and lung disease
    C. duration of MV and prior antibiotic usage
    D. impaired defence mechanisms and nasogastric tube

13. What is the timeframe in which the oropharyngeal flora of the critically ill patient changes to virulent organisms predisposing to VAP?
    A. within 12 hours
    B. within 24 hours
    C. within 36 hours
    D. within 48 hours

14. The prevention of VAP should include which of the following?
    A. all members of the health care team
    B. ongoing education
    C. stringent infection control measures
    D. all of the above

15. Which statement best describes the rationale of sedation vacation?
    A. waking up the patient daily to determine their neurological status and readiness to wean
    B. withholding sedation for a predetermined length of time to reduce the amount of sedation the patient receives to save money
    C. to give the patient a continuous infusion of sedation, without any interruptions, a “chemical holiday”
    D. sedation vacation is not evidence-based

16. True or false: Critical care nurses are pivotal in the prevention and eradication of VAP?
    A. true
    B. false
CE Quiz

Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses

CE Quiz Enrolment Form  CACCN07-2  CE Hours = 1.0

Photocopy this form and mark your answers in the appropriate spaces.
This form expires on October 1, 2008.

Quiz topic: Interventions by critical care nurses reduce VAP

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   C   C   C   C   C   C
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Epidural medications given intravenously may result in death

By Christine Koczmarz, RN, BScPsy,
Sylvia Hyland, BScPhm, MHSc (Bioethics),
and Roger Cheng, BScPhm, PharmD

Abstract

Anesthetics, such as bupivacaine, intended for epidural analgesia can cause severe cardio- and neurotoxicity when inadvertently administered via the intravenous route. This article highlights a case report and the dangers associated with the inadvertent administration of an epidural solution intravenously. Multiple system-based strategies for prevention are provided.

Practitioners in critical care units routinely care for post-operative patients receiving continuous epidural infusions for pain management. Critically ill patients commonly have multiple lines and tubes in place for the administration of medications (e.g., central, peripheral, gastric), as well as for monitoring their status (e.g., arterial line, central line). Previous reports of mix-ups between intravenous (IV) and epidural medications have often focused on the risk for harm if an IV product is inadvertently given epidurally (or intrathecally) (Hew, Cyna, & Simmons, 2003; ISMP, 1998, September; ISMP, 2000; ISMP, 2006, April; JCAHO, 2005; Landow, 1985; Salvolini, Bonetti, & Ciritella, 1996; Sigg & Leiken, 1999). The following case report highlights the dangers associated with a reverse mix-up (i.e., epidural premixed solution inadvertently administered IV) and the numerous system safeguards that should be considered to prevent such an occurrence.

Case report

An event in the United States (U.S.) demonstrates the high risk of harm if medications intended for epidural administration are inadvertently administered intravenously (ISMP, 2006, August; Wahlberg, 2007):

A healthy 16-year-old girl died during labour after an epidural analgesic (presumably containing bupivacaine) was inadvertently infused intravenously. The nurse had intended to administer a minibag containing penicillin. Five minutes after the start of the infusion the patient was noted to experience "seizures, clenched jaw and gasping respirations" (WISCTV, 2006). Efforts to resuscitate the patient were unsuccessful.

System safeguards are required

Anesthetics intended for epidural (or spinal) analgesia can lead to severe adverse events when administered intravenously in error. For example, the inadvertent IV rather than epidural administration of bupivacaine can lead to cardiotoxicity (bradycardia, hypotension, heart block, ventricular arrhythmias including ventricular fibrillation) and neurotoxicity (e.g., excitation, restlessness, paresthesia, dizziness, blurred vision, tremors, shivering preceding the onset of generalized convulsions) (MicroMedex, 2007). Cases of cardiotoxicity and neurotoxicity resulting in serious harm have also been reported with the injection of regional anesthetics (Bacsik, Swift, & Hargreaves, 1995; Hew et al., 2003; Litz, Popp, Stehr, & Koch, 2006). Multiple system safeguards that should be considered to prevent such an occurrence.

System safeguards to consider

The case identifies and emphasizes the need to ensure there is adequate segregation and differentiation between IV and epidural products, as well as the need to ensure distinctive processes in the medication use system for handling and administration of these products. A summary of previously shared recommendations from ISMP in the U.S. and ISMP Canada, related to prevention of substitution errors between intravenous and epidural medications, is noted here.

- Keep premixed epidural solutions separate from intravenous solutions during all phases of the medication use process, including drug preparation, delivery, retrieval and administration (ISMP, 2003; ISMP Canada, 2006). While the increased availability of premixed solutions is promoted (Cohen, 2007; ISMP Canada, 2005), there also need to be system safeguards in place that reduce the potential risk for substitution errors with look-alike premixed solutions (ISMP Canada, 2006).
- Ensure that all medication labels prominently identify the route of administration (ISMP Canada, 2003; ISMP Canada, 2006).
- Require distinctive labelling that readily distinguishes epidural solutions from intravenous solutions. Use brightly coloured auxiliary labels to differentiate epidural solutions (e.g., for EPIDURAL USE ONLY) (ISMP Canada, 2005).
- Store epidural solutions in a separate storage area, away from other premixes. Keep them sequestered until needed for administration (ISMP Canada 2005; ISMP Canada, 2006).
- Retrieve and administer epidural medications at a separate time from the administration of intravenous solutions (ISMP Canada, 2006).
- Restrict stocking of epidural solutions to patient care areas that require them, based on patient population and drug use evaluation (ISMP Canada, 2005; ISMP Canada, 2006). Whenever possible, epidural solutions should be dispensed from pharmacy on a patient-specific basis so the label includes the patient’s name and patient care area.

Additional general recommendations designed to ensure distinctive processes for administration of epidural medications include:

- Use distinctly coloured epidural tubing to differentiate it from other tubing (ISMP, 1998, June; ISMP Canada 2005; ISMP Canada, 2006).
- Use tubing without injection ports for epidural administration to prevent the inadvertent administration (direct injection or piggyback) of other medications via the epidural line (ISMP Canada, 2003; ISMP Canada 2005; ISMP Canada, 2006).
• Use brightly coloured labels to identify epidural solution and epidural infusion lines. Labelling lines at the distal connection site has been recommended (ISMP, 1998, June; ISMP, 1998, June; ISMP Canada, 2003; ISMP Canada, 2005; ISMP Canada, 2006).
• Use single-channel pumps for epidural infusions (ISMP Canada, 2003; ISMP Canada, 2005; ISMP Canada, 2006).
• Consider using dedicated infusion pumps for epidural use and have biomedical engineering pre-program the maximum infusion rate to a predetermined level (e.g., 20 mL/hour). Add a large visible label marked “Epidural Pump” on the pump being used to administer an epidural infusion (ISMP Canada, 2005; ISMP Canada, 2006).
• Physically separate epidural pumps from other pumps. Some hospitals encourage placing the epidural pump and IV pump on opposite sides of the bed, when patients are not ambulating, to better distinguish the two infusions (ISMP Canada, 2005; ISMP Canada, 2006).
• Consider an independent double-check policy and associated documentation for epidural infusions to verify patient identification, correct medication and its concentration, and route of administration upon initial programming and changes in programming of the infusion pump (ISMP Canada, 2003; ISMP Canada, 2005; ISMP Canada, 2006).
• Ensure training and competency assessment of all staff before they are required to work with patients with epidurals, including those receiving epidural infusions (ISMP Canada, 2005; ISMP Canada, 2006).
• Widely share this information with staff/peers to heighten awareness of the risk for mix-ups between epidural and IV medications (ISMP Canada, 2003).

Bar-coding technology is designed to help prevent substitution errors. According to the media reports at the time, a contributing factor to this incident was failure to use bar-coding technology that had been implemented and was “policy but not practice” in the hospital (WISCTV, 2006). This incident serves to remind us all of the need to (i) identify the barriers for successful implementation, and (ii) provide ongoing training, monitoring and evaluation when there has been investment in new technologies designed for enhanced patient safety.

In addition to all the steps health care providers and health care organizations can take to prevent misidentification of infusion products, an ideal safeguard is a “lock and key” redesign of bags, tubing and catheters so that medications intended for epidural use cannot be connected to intravenous lines or vice versa. This is similar to the changes made to products for use with gastric tubes – distinct pumps, lines and oral syringes that cannot interconnect to equipment intended for IV use.

Additional information
It has been reported that even with supportive measures, including administration of IV fluids, vasopressors and cardiopulmonary resuscitation, resistance to aggressive measures usually occurs after cardiovascular collapse associated with toxicity from anesthetics such as bupivacaine (Bacsik et al., 1995). Of special interest, two case reports describe the use of intravenous 20% lipid emulsion (administered intravenously) for successful resuscitation following a cardiac arrest likely caused by systemic toxicity of local anesthetic products (bupivacaine and ropivacaine) (Rosenblatt et al., 2006; Litz et al., 2006). Although these reports are anecdotal in nature, lipid emulsion has been shown to increase the cardiotoxic threshold of bupivacaine in animal studies (Weinberg, VandeBoncouer, Ramaraju, Garcia-Amario, & Cwik, 1998; Weinberg, Ripper, Feinstein, & Hoffman, 2003). A recent editorial suggested having 20% lipid emulsion available where regional anesthesia is performed. The author of the editorial noted that use of 20% lipid emulsion should be considered only after standard resuscitative measures have proven ineffective for cardiac arrest induced by a local anesthetic agent (Weinberg, 2006). In addition, Weinberg (2006) emphasizes that propofol, with its 10% lipid emulsion base, is NOT to be used as a substitute as it can also increase cardiotoxicity in the higher doses that would be required under these circumstances. (For further information, including suggested IV dosing of 20% lipid emulsion, we would encourage readers to consult the cited references and other documents in the medical literature.)

Conclusion
Consider how epidural solutions are managed in your critical care area. Review and consider where failure points in the process may exist. All practitioners handling and administering these medications can often identify potential failure points and may even have knowledge of near misses that would assist in identifying strategies to improve safety. Implementing multiple system safeguards to prevent the inadvertent intravenous administration of epidural solutions containing anesthetics is paramount. Safety can be enhanced by focusing on how to make the system or process of administering epidural medications less error prone (i.e., to prevent errors or to facilitate practitioners to catch errors and take corrective action). Collectively and in collaboration with other health care providers, critical care practitioners can influence changes within their organization that can prevent the inadvertent IV administration of epidural solutions.

This article was written using materials from ISMP Canada including a Safety Bulletin (ISMP Canada, October 5, 2006; ISMP Canada, January 2003), with permission from ISMP Canada.

ISMP Canada gratefully acknowledges the valuable lessons learned and information reported by professionals in the Canadian health care community that can then be shared to enhance medication system safety.

ISMP Canada is a national voluntary medication incident and ‘near miss’ reporting program founded for the purpose of sharing the learning experiences from medication errors. Implementation of preventative strategies and system safeguards to decrease the risk for error-induced injury and thereby promote medication safety in healthcare is our collaborative goal.
Medication Incidents (including near misses) can be reported to ISMP Canada:
(i) through the website http://www.ismp-canada.org/err_report.htm or
(ii) by phone: 416-733-3131 or toll free: 1-866-544-7672.

ISMP Canada guarantees confidentiality and security of information received, and respects the wishes of the reporter as to the level of detail to be included in publications.

ISMP Canada is a key partner in the Canadian Medication Incident Reporting and Prevention System. ISMP Canada can be contacted by email: cmirps@ismp-canada.org. All ISMP Canada Safety bulletins are available from http://www.ismp-canada.org/ISMPCBSafetyBulletins.htm.

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References


CACCN Chapter of the Year Award Program

Purpose
The Chapter of the Year Award is to recognize the effort, contributions and dedication of a chapter of CACCN in carrying out the purposes and goals of the association.

Criteria for the award program
1. The award program will be for the period of April 1-March 31 each year.
2. Chapters may win the award for one year followed by a two-year lapse before entering again.
3. A point system has been developed to evaluate chapter activities during the year. The chapter with the most points will be the winner of the Chapter of the Year Award. CACCN reserves the right to adjust points depending upon supporting materials submitted.
4. The award winner will be announced at Chapter Connections Day and at the annual awards ceremony at Dynamics.

Conditions for the award program:
All chapters of CACCN are eligible to participate provided they have on file at national office all of their financial (quarterly) and activity (annual) reports required for the qualifying period.

If the above conditions are not met, the entry will be disqualified. The winning chapter will receive a plaque and cheque for $500.00 that will be presented at that year’s Dynamics.

Announcement of the winner will be published in CACCN publications.

Categories and their corresponding points that will be used to determine the winning chapter are as follows:
1. Any educational programs, with an accompanying brochure or pamphlet, that occurred during the fiscal year.

Programs between:
1-3 hours............25 points each
3-8 hours............50 points each
> 8 hours ............100 points each

2. A list of new members recruited during the fiscal year, including national CACCN membership numbers. Calculate your points based on the percentage of new members recruited as compared to the total membership of the previous fiscal year (prior to the qualifying period).

1-10%..............10 points
11-20%............20 points
21-30%.............30 points
31-40%............40 points
41-50%............50 points
51-60%............60 points
61-70%............70 points
71-80%............80 points
81-90%............90 points
91-100%.........100 points

3. Evidence of member attendance at each program or meeting provided by the chapter

4. Evidence of chapter members who have contributed articles to either the chapter newsletter, or had a paper published in Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses. 25 points for each article/paper

5. Projects that provide public education, community service and/or promote the image of critical care nursing. These projects must be presented under the auspices of the CACCN chapter (i.e., participating in blood pressure clinics, teaching CPR to the public, participating in health fairs). Validation must be provided that the event was a CACCN-sponsored project by, for example, submitting a letter from the receiving group or a picture of the event, etc. 50 points for each project

In the case of a tie, CACCN reserves the right to determine the winner. Good luck in your endeavours!

Sorin Group sponsors this award

CACCN Research Grant

Grant available:
A CACCN research grant has been established to provide funds ($1,000.00) to support the research activities of a CACCN member that are relevant to the practice of critical care nursing. A grant will be awarded yearly to the investigator of a research study that directly relates to the practice of critical care nursing.

Eligibility:
The principal investigator must:
• Be a member of CACCN in good standing for a minimum of one year.
• Be licensed to practise nursing in Canada.
• Conduct the research in Canada.
• Publish an article related to the findings in Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses.

CACCN members enrolled in graduate nursing programs may also apply. Members of the CACCN board of directors and the awards committee are not eligible.

Application requirements:
• A completed application form.
• A grant proposal not in excess of five pages exclusive of appendices. Appendices should be limited to essential information, e.g., consent form, instruments and budget.
• A letter of support from the sponsoring agency (hospital, clinical program) or thesis chairperson/adviser (university faculty of nursing).
• Evidence of approval from an established institutional ethical review board for research involving human subjects and/or access to confidential records. Refer to the CNA publication Ethical Guidelines for Nursing Research Involving Human Subjects.
• Brief curriculum vitae for the principal investigator and co-investigator(s) describing educational and critical care nursing background, CACCN participation, and research experience. An outline of their specific research responsibilities is to be included.
• Proof of CACCN active membership.
Budget and financial administration:
• Funds are to be issued to support research expenses.
• Funds must be utilized within 12 months from the date of award notification.

Review process:
• A research review committee will review each proposal. Its recommendations are subject to approval by the board of directors of CACCN.
• Proposals are reviewed for potential contribution to the practice of critical care nursing, feasibility, clarity and relevance.
• Deadline for receipt of application in CACCN national office is February 15. The recipient of the research grant will be notified by mail.

Terms and conditions of the award:
• The research award is to be initiated within six months of the receipt of the grant. Any changes to the study timelines require notification in writing to the board of directors of CACCN.
• All publications and presentations arising from the research study must acknowledge CACCN.
• A final report is to be submitted to the board of directors of CACCN within three months of the termination date of the grant.
• An article related to the research study is to be submitted to Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses, for publication.

Deadline for submission February 15

Editorial Awards

The awards
The Editorial Awards will be presented to the authors of two written papers in Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses, which demonstrate the achievement of excellence in the area of critical care nursing. A $750.00 award, provided by Edwards Lifesciences, will be given to the author(s) of the best article, and $250.00, provided by 3M, is given to the author(s) of the runner-up article. It is expected that the money will be used for professional development. More specifically, the recipient must use the funds:

1. Within 12 months following the announcement of the winners, or within a reasonable time;
2. To cover and/or allay costs incurred while attending critical care nursing-related educational courses, seminars, workshops, conferences or special programs or projects approved by the CACCN, and
3. To further one’s career development in the area of critical care nursing.

Eligibility
1. The author is an active member of the Canadian Association of Critical Care Nurses (minimum of one year). Should there be more than one author, at least one has to be an active member of the Canadian Association of Critical Care Nurses (minimum of one year).

2. The author(s) is prepared to present the paper at Dynamics of Critical Care (optional).
3. The paper contains original work, not previously published by the author(s).
4. Members of the CACCN board of directors, awards committee or editorial committee of Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses are excluded from participation in these awards.

Criteria for evaluation
1. The topic is approached from a nursing perspective.
2. The paper demonstrates relevance to critical care nursing.
3. The content is readily applicable to critical care nursing.
4. The topic contains information or ideas that are current, innovative, unique and/or visionary.
5. The author was not the recipient of the award in the previous year.

Style
The paper is written according to the established guidelines for writing a manuscript for Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses.

Selection
1. The papers are selected by the awards committee in conjunction with the CACCN board of directors.
2. The awards committee reserves the right to withhold the awards if no papers meet the criteria.

Presentation
Representatives of the sponsoring company or companies will present the awards at the annual awards ceremony during the Dynamics conference. Their names will be published in Dynamics, the Official Journal of the CACCN.

The Spacelabs Innovative Project Award

The Spacelabs Innovative Project Award (valued at $500.00) will be presented to a group of critical care nurses who develop a project that will enhance their professional development. The primary contact person for the project must be an active member of CACCN (for at least one year). If the applicant(s) are previous winners of this award, there must be a one-year lapse before submitting again. Applications must be received in CACCN national office on or before January 15. Presentation of the award will be made at Dynamics.

Applications will be judged according to the following criteria:
1. The number of nurses who will benefit from the project
2. The uniqueness of the project
3. The relevance to critical care nursing
4. Consistency with current research/evidence
5. Ethics
6. Feasibility
7. Timeliness
8. Impact on quality improvement.
Within one year, the winning group of nurses is expected to publish a report that outlines their project in *Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses*.

Do you have a unique idea?

**SMITHS Educational Awards**

The CACCN Educational Awards have been established to provide funds ($750.00 each) to assist critical care nurses to attend continuing education programs at the baccalaureate, masters and doctorate of nursing levels. All critical care nurses in Canada are eligible to apply, except members of the CACCN board of directors.

**Criteria for application**

1. Be an active member of CACCN in good standing for a minimum of one (1) year.
2. Demonstrate the equivalent of one (1) full year of recent critical care nursing experience in the year of the application.
3. Be an active member (minimum of one [1] year) of CACCN committee(s) and/or participate in other chapter-related activities. Past participation is acceptable.
4. Submit a letter of reference from his/her current employer.
5. Be accepted to an accredited school of nursing or recognized critical care program of direct relevance to the practice, administration, teaching and research of critical care nursing.
6. Incomplete applications will not be considered; quality of application will be a factor in selecting winners.
7. Was not the recipient of this award in the past two years?
8. Deadlines for receipt of applications in national office are: September 1 and January 31 of each year.

**Application process**

1. Submit completed CACCN educational award application forms to national office (forms package can be requested from national office).
2. Obtain a minimum of 250 merit points (preference will be given to members with the highest number of merit points).
3. Keep a record of his/her own merit points, dating back three (3) years (forms included in package).
4. Submit all required documentation outlined in criteria. Candidate will be disqualified if documentation is not submitted with application.

**Post-application process**

1. All applications will be acknowledged in writing from the awards committee.
2. The awards committee will notify unsuccessful applicants individually.

Winners will be acknowledged at the awards ceremony at the annual Dynamics conference and their names will be published in *Dynamics, the Official Journal of the CACCN*.

**Chapter Recruitment and Retention Award**

This CACCN initiative was established to recognize the chapters for their outstanding achievements with respect to recruitment and retention.

**Recruitment Initiative**

This initiative will benefit the chapter if the following requirements are met:

- If the chapter recruits 25-49 new members from April 1 to March 31 of the next year, they receive one full tuition to *Dynamics* of that year.
- If the chapter recruits 50-100 new members from April 1 to March 31 of the next year, they receive one full tuition and one $100.00 coupon to *Dynamics* of that year.

**Retention Initiative**

This initiative will benefit the chapter if the following requirements are met:

- If the chapter has 100% renewal of its previous year’s members, the chapter will receive three $100.00 coupons to *Dynamics* of that year.
- If the chapter has greater than 80% renewal of its previous year’s members, the chapter will receive two $100.00 coupons to *Dynamics* of that year.
- If the chapter has greater than 60% renewal of its previous year’s members, the chapter will receive one $100.00 coupon to *Dynamics* of that year.

**BBraun Mentorship Award**

This award (valued at $1,000.00) will be presented to an individual who exhibits stellar leadership and mentoring abilities in critical care. The candidate is an individual who supports, encourages, and teaches colleagues. The candidate must demonstrate a strong commitment to the practice of critical care nursing and the nursing profession. These qualities may be demonstrated by continuous learning, professional involvement, and a commitment to guiding novice nurses in critical care. Each nomination must have the support of another colleague and the individual’s manager. It is not necessary for the candidate to be in a formal leadership or education role to qualify for this award.

**Criteria:**

- Nominee must be a CACCN member
- The nominee must have at least three years of critical care nursing experience
- CACCN board of directors are not eligible
- At least one nomination letter must be written by a CACCN member
- Preference is given to a mentor who has CNA certification
- The nominee must demonstrate an awareness of and adherence to the standards of nursing practice as determined by the provincial nursing body, and the Standards of Critical Care Nursing (2004)
Three letters of support are required:
• The nominator must outline the qualities of the candidate, and reasons the candidate should be chosen to receive the award.
• Two additional letters must testify to the eligibility of the candidate as well as outline his/her attributes (one must be written by the nominee’s manager).
• All three letters must be sent by electronic mail by each person on the same day with the subject matter: “Braun Mentorship Award – Candidate’s Name” to the director responsible for awards at National Office.

Selection Process:
• Each nomination will be reviewed by the awards committee in conjunction with the CACCN director of awards & sponsors.
• The successful candidate will be notified by mail, recognized at the annual awards ceremony at the Dynamics conference and her/his name will be published in Dynamics, the Official Journal of the CACCN.
• The awards committee reserves the right to withhold the award if no candidate meets the criteria.
• The funds may be used to attend educational programs or conferences related to critical care.

Deadline for nominations: March 1

The Guardian Scholarship – Baxter Corporation Award for Excellence in Patient Safety

The Baxter Corporation Guardian Scholarship will be presented to an individual or an interdisciplinary team who propose to make, or who have made, significant contributions toward patient and/or caregiver safety in the critical care environment. Recipients of this award will identify ideas that encompass safety and improve the quality of care in their practice area.

Eligibility
The principal investigator (or applicant) must:
• Be a member of CACCN in good standing for a minimum of one year.
• Be licensed to practise nursing in Canada.
• CNA certification preferred.

Members of the awards committee or the board of directors are not eligible.

Application Requirements:
• The projects will be consistent with the theme of the upcoming Dynamics conference.
• The project will describe an innovative approach, to develop new or revised processes, to encompass patient safety and improve the quality of care at the unit, hospital or health care system level.
• The project/proposal will show evidence of collaboration among team members.

A complete application form that includes:
• A proposal of a project, or a description of a completed project, which makes a significant contribution toward patient and caregiver safety in critical care. The proposal will include the background perspective, statement of the problem, and intended means to change practice. The proposal should include a timeline by which the project will occur.
• Approval from an established institutional ethical review board for projects involving human subjects and/or access to confidential records, if applicable. (Applicant may refer to the CNA publication, Ethical Guidelines for Nursing Research Involving Human Subjects, or the research review process in their institution).
• Brief curriculum vitae for the principal applicant and team members describing educational and critical care nursing background and CACCN participation.
• Proof of active CACCN membership.
• Proof of CNA certification in critical care (if applicable).

Review Process
• A committee made up of a member of the CACCN BOD, a member of the Baxter Corporation and a member of the CACCN Annual Conference Planning Committee (preferably the Chair) will review each proposal.
• Proposals are reviewed for their contribution to patient safety, evidence of transferability of the project, innovation, sustainability, and leadership within critical care practice areas.
• Deadline for receipt of applications is June 1 of each year.
• The successful candidate will be notified in writing.

Terms and Conditions of the Award
• A proposed project must be initiated within three months of the receipt of the scholarship.
• Any changes to the timelines require written notification to the board of directors of CACCN.
• All publications and presentations must recognize the Baxter Corporation and CACCN.
• An article related to the project is to be submitted to Dynamics, the Official Journal of CACCN, for publication and the project will be presented at a future Dynamics conference.

Budget and Financial Administration
• One-half of the awarded funds will be available to support the project expenses immediately.
• The remaining funds will be awarded upon the publication of an article describing the project in Dynamics, the Official Journal of CACCN.
• The total funds available are $5,000.00. The award funds may be granted to a maximum of two applicants ($2,500.00 each).

NOTE: The CACCN Board of Directors & Baxter Corporation retain the right to amend the award criteria.
The Canadian Association of Critical Care Nurses is a non-profit, specialty organization dedicated to maintaining and enhancing the quality of care provided to critically ill patients and their families. We serve the public, our members and the critical care nursing community by meeting the professional and educational needs of critical care nurses.

These needs are met by:
• developing and implementing standards of critical care nursing practice
• providing educational opportunities
• supporting and facilitating critical care nursing research
• providing opportunities for networking
• identifying and addressing political and professional issues
• collaborating with other professional organizations

i) to provide informed guidance in shaping the delivery system as it relates to the care of the critically ill
ii) to determine standards for critical care nursing
iii) to determine certification standards for national testing for the specialty of critical care nursing
iv) to promote and provide educational opportunities
v) to improve the quality of patient care through the promotion of nursing research in critical care
vi) to promote membership and chapter development.

Application for membership

Name: ____________________________________________________________
Address: __________________________________________________________

(Street)

(City) (Province) (Postal Code)

W (____) ____ - ________ H (____) ____ - ________ F (____) ____ - ________

Employing Agency: _________________________________________________

Position: __________________________________________________________

Area of Employment: _______________________________________________

Nursing Registration No.: ______________________ Province: _____________

Chapter Affiliation: _________________________________________________

Sponsor’s Name: ___________________________________________________

Please check one:

☐ New Member $75.00 (includes 6% GST)
☐ Renewal $75.00 (includes 6% GST) - Present Number ________________

Are you a CNA member? ☐ Yes, ☐ No

Signature: ________________________________________________________

Date: __________________________________________________________________

Please Note: This application is for both national and chapter membership.

Make cheque or money order payable to:
Canadian Association of Critical Care Nurses (CACCN)
Mail to: CACCN, P.O. Box 25322, London, Ontario, N6C 6B1
Telephone: (519) 649-5284, Fax: (519) 649-1458
e-mail: caccn@caccn.ca
www.caccn.ca
D Y N A M I C S
The Official Journal of the Canadian Association of Critical Care Nurses

Information for Authors

Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses (CACCN), is distributed to members of the CACCN, to individuals, and to institutions interested in critical care nursing. The editorial board invites submissions on any of the following: clinical, education, management, research and professional issues in critical care nursing. Critical care encompasses a diverse field of clinical situations which are characterized by the nursing care of patients and their families with complex, acute and life-threatening biopsychosocial risk. While the patient’s problems are primarily physiologic in nature, the psychosocial impact of the health problem on the patient and family is of equal and sometimes lasting intensity. Articles on any aspect of critical care nursing are welcome. The manuscripts are reviewed through a blind peer review process. Manuscripts submitted for publication must follow the following format:

1. Title page with the following information:
   • Author(s) name and credentials • Place of employment • If there is more than one author, the names should be listed in the order that they should appear in the published article • Indicate the primary person to contact and address for correspondence.

2. A brief abstract of the article on a separate page not to exceed 100 words.

3. Body of manuscript:
   • Length: a maximum of 15 pages including tables, figures and illustrations, and references • Format: double spaced, 1 1/2 inch margins on all sides. Pages should be numbered sequentially including tables, figures and illustrations. Prepare the manuscript in the style as outlined in the American Psychological Association’s (APA) Publication Manual 5th Edition. • Tables, figures, illustrations and photographs must be submitted each on a separate page after the references. • References: the author is responsible for ensuring that the work of other individuals is acknowledged accordingly. Direct or indirect quotes must be acknowledged according to APA guidelines • Permission to use copyrighted material must be obtained by the author and included as a letter from the original publisher when used in the manuscript.

4. Copyright:
   • Manuscripts submitted and published in Dynamics become the property of the CACCN. Authors submitting to the journal are asked to enclose a letter stating that the article has not been previously published and is not under consideration by another journal.

5. Submission:
   • Please submit the manuscript electronically as a Word attachment to the editorial office as printed in the journal. Accepted manuscripts are subject to copy editing.
Spacelabs Healthcare Delivers

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