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CHAIRPERSONS REPORT

Welcome

Happy New Year!!! We must apologise to all our members the delay in the newsletter.

This year our main goal is to develop standards of clinical practice and clinical competencies. The committee have been working with ACORN to develop the national ACORN PACU standards. This process requires much time to review the draft standards.

VSPAAN will develop our own standards with reference to the ACORN PACU standards. We will also develop guidelines for clinical practice for perianaesthesia nurses. However, this process will take time – we appreciate your patience.

VSPAAN aims to provide education and exchange professional knowledge through a variety of formats. The next combined education seminar is at the Royal Childrens Hospital on Saturday 27th March 2004. Please encourage your colleagues and friends to come along.

This year Robin Riley has been successful in obtaining some funding from VSPAAN to undertake her research project which is looking at Post Anaesthetic Discharge scoring. Congratulations to Robin.

We encourage you to maintain your memberships and inform all your colleagues.

You can access membership forms from the website or contact one of the committee members.

Look forward too seeing you at seminar in March.

Regards

Jane Anthony
Chairperson

Editor.....

I have been formatting the VSPAAN newsletter for the past 21/2 years. It is now time for me to hang up the keyboard and hand the role on to someone else. I have enjoyed all the work that I have done on the VSPAAN committee and have gained a whole new perspective of what VSPAAN does for the profession, and for its members. I recommend to anyone to join the VSPAAN committee for a great insight to this group who is improving standards and knowledge for many perianaesthesia nurses.

I hand over to Chris Vanderstock from Cabrini hospital who is a bit of a computer wizz so I hope that there will be many positive changes to the look of the newsletter. To help him in this new role I ask members to send in any articles that they may think are interesting. Any quality programs that your department is involved in oreven an extract of any assignments.

Thank you for your support .

Karen Briggs

Patient Education and The Internet

Gary Martin

Introduction

The use of the Internet as a means of research and continuing self-education for nurses is becoming more widely utilised. Moreover, the Internet is being used by patients and other interested parties to to gain knowledge about disease processes and treatments. The later has serious ramifications for nursing care. Patients may have knowledge about their specific condition which the nurse is not familiar with. Patients may also be armed with spurious information gained from the Internet. In this instance, the nurse must be prepared to direct the patient's enquiry towards better researched information.

The Internet

The methods by which people gain health care information have undergone revolutionary changes [1]. The Internet has allowed anyone with a computer and a telephone line to access the latest scientific knowledge, such as research papers published in medical and medical science journals. Cutting edge research papers are now freely available from even prestigious medical journals published on the Internet such as The Lancet and the BMJ. The advantages of this information revolution for health care workers and individuals are numerous. The pitfalls of such a vast, largely uncontrolled information source are harder to discern, but nonetheless real. The negative aspects of universally available health information not reviewed by professionals has become an issue, especially to health care workers who find themselves confronted by "informed" patients [2].

Many individuals who are suddenly struck with a serious medical problem have an insatiable thirst for knowledge about their condition. In the past, they had to rely on health care professionals for information. This situation has changed with the advent of the Internet. Now anyone with access to a computer has access to the latest medical information. Most however, do not have formal training in the rules of evidence to discern between valid information and someone's opinion. Individuals suddenly struck down with a life altering disease are desperate for answers and are very open to influence. Someone with an axe to grind and an Internet site can do immense damage to the trust that must be inherent within the nurse - patient relationship. It is unlikely that nurses will be able to effectively inform their patients if they don't have Internet research skills.

Nurses as a group are generally not well educated in computer technology and struggle to keep pace with patients, who are turning to the Internet in search of health-related information [3]. The factors influencing nurses poor utilisation of the Internet for evidence based research include lack of training in the use of computer technology, limited access to computers in the workplace and time constraints [4]. It has also been suggested that nurses value the knowledge gained from peers and personal experience above either printed journals or on-line media [3]. Patients don't have access to these same resources, and are using the Internet in increasing numbers for health related information. With Internet users growing at an exponential rate, nurses will be ill-equipped to deal with patients who have armed themselves with information from the Internet, unless they have the capability to stay abreast of new research [3].

Research and the rules of evidence

It is presumed that a modern, well educated nurse has an understanding of evidenced based practise and how to discern valid research findings from the leading story in the health section of the local newspaper. This skill would have been taught to them during their first year of undergraduate study. However, they may not be able to extrapolate this knowledge to the a completely different medium, such as the Internet. A recent study showed that nurses rely heavily on intuition to evaluate practise related information on the Internet [5]. Nurses who trained before the advent of University based nurse education may not have have a very thorough grounding in the rules of evidence needed to integrate valid research findings into their practise.

Internet sites containing health related information vary greatly in the quality of that information. Unlike journals, which are limited in their number due to the production costs involved, and thus only survive if they are subscribed to; Internet sites are cheap to construct, and even cheaper to maintain. If nobody visits the site, it doesn't matter - the site will not cease to exist. Therefore, useless sites containing health related information proliferate the Internet. This makes the task of determining which information is evidence-based and of good quality more difficult than in the print media. Of course, there are many well established, reputable health related journals which publish their content on the Internet as well as in print. These should generally be considered good sources of health related information. Others will have to undergo a critical analysis of its content before being recommended.

Some of the attributes which determine the quality and relevance in a journal can also be, and should be applied to health information web sites [5, 6]:

* Author: Is the name of the Author published. Does the Author have formal qualifications in the field of discussion.
* Editor: Is there an Editor to take responsibility for the content published on the site. Are conflicts of interest acknowledged.
* Currency: Is the date of publication displayed on the site - some web sites are programmed to automatically generate the current date when visited.
* Content: Are the research methods used reliable. Are limitations of the information acknowledged.
* Objective: Is the content 'information' based or is the page designed to sway opinion. Is the site sponsored by advertising. Is the advertising differentiated from the content.
* References: Are references included to validate the content. Are they current and of good quality.
* Contact: Can the Author/Editor/Publisher be contacted for verification purposes.

Being proactive

Teaching patients the basic research skills needed to assess the quality of health related information on the Internet will have to become one of the nurse's patient-care skills [7]. Patients in need of answers will turn to the Internet regardless of advice to the contrary. The teaching of critical analysis cannot be taught by the nurse it they don't understand it themselves. The research skills specific to the medium of the Internet must be learnt by nurses caring for patients in the Internet Age.

It is important that nurses do not become overly defensive when confronted with patients armed with knowledge about their condition gained from the Internet. The nightmare scenario of your patient telling you that he read on the personal web page of Mr Jones how he was cured of cancer using Chinese herbs, so why can't he be cured -- needs a disciplined and critical explanation by the nurse.

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Mechanical Ventilation for Acute Respiratory Distress Syndrome

Brent Law RN

Respiratory distress syndrome (ARDS) was first described in 1967 and since then has been the focus of intense research in to attempt to improve patient outcome. In 1994 The European-American Consensus Committee on ARDS reviewed the definition for ARDS to aid in early identification of patients to enable early interventions to take place and improve patient outcome. The committee concluded that ARDS is the severe form of acute lung injury (ALI) and defined them as follows:

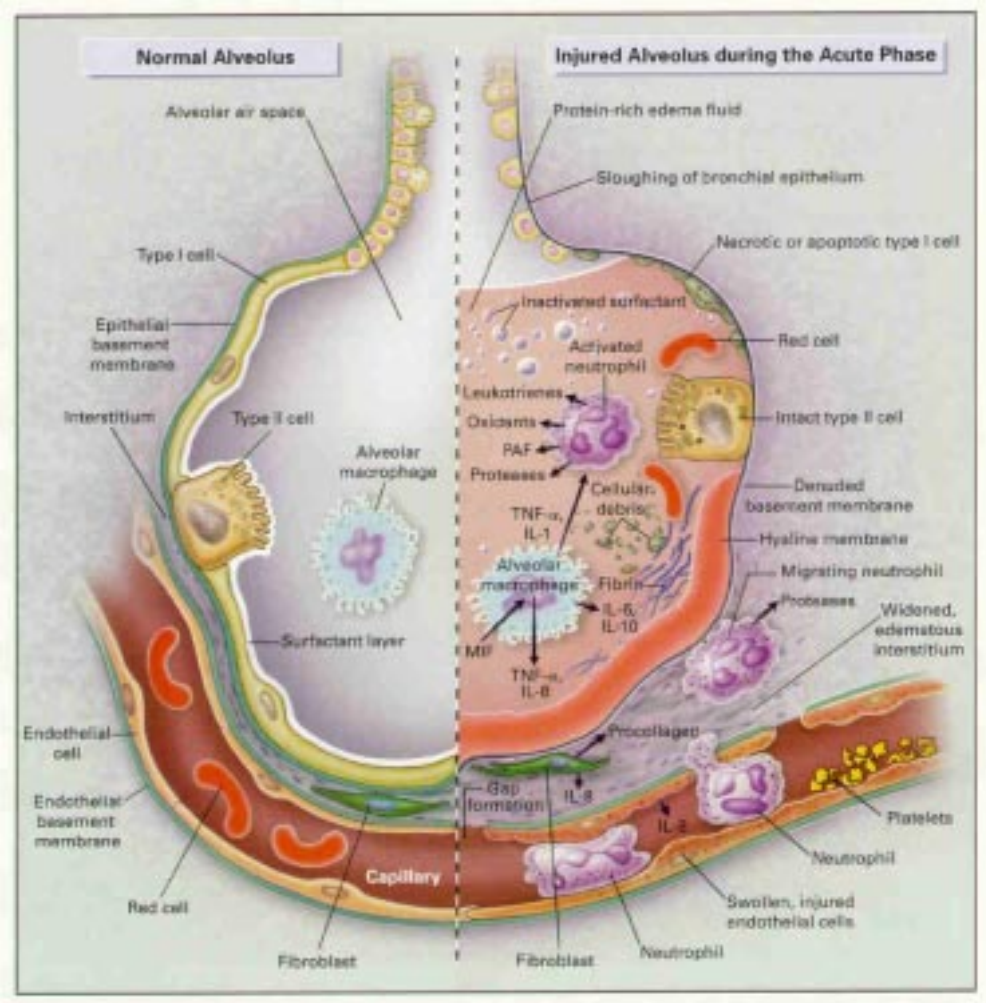
1. Acute onset
2. Bilateral infiltrates on chest X-ray
3. Hypoxemia
4. No evidence of left atrial hypertension (PAWP <= 18 mmHg)

The degree of hypoxemia delineates between ALI and ARDS, hypoxemia in ARDS is more severe with a PaO_2/FiO_2 ratio <= 200 whereas ALI is defined as a PaO_2/FiO_2 ratio <=300.

Unfortunately there is no direct cure for ARDS and the mainstay of treatment is mechanical ventilation which acts as a supportive measure to help rest the lungs and allows time for the lungs to heal. From the literature there are a number of different ventilation strategies that have been used to treat ARDS but as yet no definitive mode has been identified or agreed upon. The following treatment regimes will be discussed to aid in the treatment of the patient in the case study; Low tidal volumes with PEEP, Pressure controlled ventilation with an inverse I:E ratio, the use of Nitric Oxide, Prone ventilation and finally the use of Extracorporeal oxygenation (ECMO).(Bulger, Jurkovich et al. 2000) To further understand why these different ventilation strategies may be initiated it helps to look at the pathophysiology that drives the ARDS process.

Pathophysiology of ARDS

Although ARDS is often referred to as a type of pulmonary, an accumulation of watery oedema fluid in the alveoli air space, ARDS is in fact a result of an inflammatory response. The predisposing factors for the onset of ARDS are bacterial or viral pneumonia, aspiration of gastric contents, near drowning, massive blood transfusion, cardiopulmonary bypass, O_2 toxicity and barotrauma but by far the most prominent factors is the presence of systemic sepsis.(Marino 1997) ARDS has three main phases:



The Acute phase which results in alveoli flooding and atelectasis.

The proliferation phase which involves the regrowth of epithelial and interstitial tissues and ;

The third phase which involves the formation of fibrous tissue in injured areas of the lung resulting in a long term change in the patient's lung compliance, residual lung capacity and there overall respiratory health.

Due to the severity of ARDS and its effect on oxygenation and the accompanied hypoxemia the mortality rate is still between 30 to 60%.(Ware and Matthay 2000)

The treatment of ARDS centres on limiting the effects of the acute or exudative phase which is characterised by the influx of protein rich oedema fluid in to the alveoli due to the increased permeability of the alveoli lining. By using the diagram below to aid in understanding the damaged caused during this phase of ARDS we can see that sloughing of the epithelial lining results in leakage of fluid into the lungs, impaired removal of oedema fluid and a decrease in the production of surfactant or abnormal surfactant. Due to the activation of the immune response the neutrophils become active and flock to the area releasing oxidants, proteases, leukotreines and other proinflamatory substances that further enhance the destruction of the epithelial lining and add to the production of oedematous fluid. Due to the activation of the inflammatory response, the initial body reaction is further damage which results in a further deterioration in the patients condition by decreasing their oxygenation therefore increasing the patient's hypoxemia and hypercapnia resulting in respiratory acidosis and failure which are the signs of ARDS. In the following two phases of ARDS the inflammatory response become helpful to the lungs and aids in tissue regeneration, but many patients do not with stand the initial onslaught and die during phase one of the disease, therefore treatment at this stage of the disease to limit the extent of respiratory failure is extremely important.(Ware and Matthay 2000)

Mechanical Ventilation

From the case study we can see that a standard ventilation protocol was not sufficient to enable a safe PaO_2 to be achieved without using extremely high airway pressures. This high airway pressure can lead to further damage of healthy lung tissue (Barotrauma) and a further decrease in respiratory performance. Therefore the cornerstone of ventilatory support is to maximise oxygenation (PaO_2) while limiting the peak inspiratory pressure (PIP) to < 30 to 40 cmH_2O. One method used in the ventilation of ARDS patients is to lower the tidal volumes of each breath well below the normal mechanical ventilation values.

Low Tidal Volume Ventilation

Normal mechanical ventilation settings for tidal volumes are 10 to 15 ml per kilogram of body weight, but due the nature of ARDS normal lung tissue is adjacent to nonrecruited lung and this results in distorted distribution of the tidal volume to the normal alveoli causing increased pressure (PIP > 50 cmH_2O) overdistension, loss of surfactant, alveoli damage and further loss of functional alveoli. To reduce this pressure related to tidal volume, ventilation for ARDS patients has been used to good effect using tidal volumes between 6 and 8 ml/kg of body weight. (The Acute Respiratory Distress SyndromeNetwork 2000) This trial showed that by decreasing the inspired tidal volume a marked decrease in PIP resulted < 30cmH_2O. This drop in pressure attributed to less barotrauma which resulted in a drop in mortality rates and the over increase in the speed of recovery. This form of ventilation has been tested by other researchers, Burns, West et al. (2001) and Koutsoukou, Bekos et al. (2002) both of which returned the same results. Bulger, Jurkovich et al. (2000) noted though that when using this type of ventilation a higher $PaCO_2$ between 80 and 100 mmHg and a pH as low as 7.15 may be tolerated. This permissive hypercapnia was also seen to aid in the survival of some patients but care must be taken to which patients this permissive hypercapnia is allowed due to effects on intracranial pressure and on patients suffering from severe coronary artery disease and heart failure. Burns, West et al. (2001) and Koutsoukou, Bekos et al. (2002) also incorporated the use of Positive End Expiratory Pressure (PEEP). The use of PEEP aids in recruiting alveoli that have collapsed by splinting them open during the expiratory phase. PEEP values between 5 and 25 cmH_2O were used with differing results in terms of increasing the PaO_2/FiO_2 ratio. The review articles written by Bulger, Jurkovich et al. (2000) and McIntyre, Pulido et al. (2000) further reinforce this type of ventilation as a well recognised ventilation mode to help support patients suffering from ARDS.

Pressure Controlled Ventilation with Inverse I:E Ratio

Another form of ventilation used to help control the pressure issues and high FiO_2 use during the ventilation of ARDS patients is Pressure Controlled Ventilation. Where the previous method of ventilation was based on delivering a set volume, pressure controlled ventilation allows the maximum amount of PIP to be set and the ventilator will then deliver a tidal volume that does not exceed that pressure. By providing a constant pressure during the whole of inspiratory phase this form of ventilation allows for greater recruitment of collapsed alveoli which results in a greater time for gas exchange to take place, therefore increasing the PaO_2/FiO_2 ratio an. (Bulger, Jurkovich et al. 2000) To further increase the time for alveoli recruitment and gas exchange and inverse I:E ratio can be used. I:E ratio refers to the time taken for the inspiratory and expiratory phases of ventilation. A usual I:E ratio is 1:2 to 1:4 that is the expiratory phase is 2 to 4 times longer than the inspiratory phase. By reversing this ratio so the inspiratory phase is longer than the expiratory phase gas trapping occurs which helps to splint alveoli open and increase the time for gas exchange thus improving $PaCO_2$ levels. The main draw back to this form of ventilation is a dramatic fall in tidal volumes if the compliancy of the lungs decreases or the amount of gas trapping related the shortened expiratory phase results in an increase in PIP close to that set by the pressure control ventilation. Pressure control ventilation can also affect the haemodynamic state of the patient due to increased thoracic pressures that reduce venous flow back to the heart. This type of ventilation is also contraindicated in patient s with head injuries as the decreased venous return from the brain may increase intracranial pressure.(McIntyre, Pulido et al. 2000) Unfortunately the use of inverse ratio ventilation has not been studied under a strict randomised trial that compared it to conventional ventilation strategies so its use is still controversial an not yet proven to provide a statistically better outcome for the patient.(McIntyre, Pulido et al. 2000).

Prone Ventilation

The use of prone ventilation is well known to aid in the ventilation status of patients, but in terms of overall outcome the use of prone ventilation has not been proven for use in ARDS patients (McIntyre, Pulido et al. 2000). However a study by Michaels, Wanek et al. (2002) in which intermittent pronation of patients was used in those that did not respond to increases in FiO_2, PEEP or PIP, showed to improve the distribution of perfusion to ventilated lung regions, increase lung volume, recruit paravertebral gas exchange areas and provide a more homogeneous distribution of ventilation . These physiological changes translated in a drop in the PIP and required FiO_2 while increasing overall oxygenation thus reducing the chances of further lung damage. did however state that the use of the prone position is not without its dangers, which include accidental extubation or kinking of the tube, damage to the oral cavity including laceration of the tongue or the development of pressure areas. The prone position also provides difficulty in general monitoring and caring for the patient especially if the patient has multiple injuries.

Nitric Oxide and the use of Extracorporeal Oxygenation (ECMO)

While these two interventions are not strictly related to the ventilation of ARDS patients they may aid in reducing FiO_2 and PIP and allow for lung rest to enable tissue repair to take place in selected patients who are in a serious unstable condition. Nitric oxide is an inhaled drug that selectively produces pulmonary vasodilation. It has been proven to increase the PaO2/FiO2 ratio by up to 20 % thus reducing the patients overall ventilation requirements (Johanningman, Davis et al. 1997). The use of Nitric oxide has not been identified to effect the overall survival rates of patients suffering from ARDS.

(Bulger, Jurkovich et al. 2000) Extracorporeal oxygenation provides a complete rest for the lungs by taking over gas exchange. This form of life support is extremely invasive and involves the placement of large bore cannulae into either peripheral or central large veins and arteries and is associated with a very high complication rate (mainly bleeding).(Chughtai, Hazan et al. 2001) The data available on this form of treatment is variable with the survival rate between 10 and 60 %. Overall this form of treatment is considered controversial and still requires a number of randomly controlled trials to validate its use. (McIntyre, Pulido et al. 2000).

Conclusion

Due to the complexities of patients suffering ARDS and the fact that our treatment regimes are focused mainly on supportive measures we still have along way to go before a definitive form of treatment is adopted. The literature suggests the use of low tidal volume ventilation setting involving a level of PEEP that further facilitates an increase in the PaO_2 / FiO_2 ratio while limiting PIP or the use of a pressure controlled setting. These two forms of ventilation are the only ones at present that have resulted in a decrease in the overall mortality rates of patients. Due to limited resources and knowledge in relation to ARDS and the ability of staff to care for such a critically ill patient in the PACU setting, patients benefit from a expedient transfer to a large ICU or a inter hospital transfer if required. If patients do not respond to the initial changes in ventilation settings the other interventions discussed in this paper may be used to prevent further deterioration in a patient's condition. Overall the ARDS patient provides a great deal of challenges when developing an effective care plan and as research in to the area continues it will be important for all health professionals to keep abreast of the latest developments in ARDS care.

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Review of Heparin in Invasive Lines

Christopher Vanderstock (ANUM, Cabrini)

Preface

Originally written late 2001, this review of heparin use in invasive lines was for internal use at St Vincent's Hospital Melbourne. Intended as both a cost benefit tool and review of the literature, this revisit has been worthwhile in that I have recently taken up an associate nurse manager position at Cabrini and asked to put forward some recommendations.

Issue

Use of heparin in invasive lines: is it necessary to maintain a patent invasive pressure line, for patient safety, longevity, and/or avoid potential complications?

Current Practice

At Cabrini, a prepared bag of Heparin 2000 international units (IU) in 1000mls of sodium chloride, in conjunction with a pressure bag, is attached to arterial lines, central venous catheters, and / or pulmonary artery catheters for hemodynamic monitoring.

When a pressure bag is properly inflated to 300 mm Hg, the pressure/transducer line will deliver approximately 3mls of fluid per hour. This is equivalent to 6 IU of heparin per hour.

Costs

Heparin sodium 2000 IU in 1000mls of sodium chloride:	$ 7.79
1000mls of sodium chloride:	$ 1.68
Price difference	= $ 6.11

Equation of cost per year:	
Number of invasive lines required per day averages	10
Five days per week (not including weekends)	(5)
52 weeks a year	(52)
Price difference per line	$6.11
Potential Saving per year	$15,886

Complications of Heparin in invasive lines

- Inaccurate readings of accumulated clotting times and other coagulation studies.
- Inadvertent thrombocytopenia.
- Anaphylaxis.
- Thromboembolism.
- Inaccurate blood pressure measurements.
- Clotted catheter tip.
- Artificially lowered blood pressure.
- Ischemia distal to arterial line insertion point.
- Phlebitis

Complications of plain (Normal Saline) invasive lines

- Clotted catheter tip.
- Thromboembolism.
- Inaccurate measurements.
- Ischaemia distal to arterial line insertion point.
- Phlebitis.

Review of the Literature

This author found surprisingly little literature and/or research into the use of heparin in invasive lines. Searches were performed on OVID full text journals, CINHAL, MEDLINE, BMJ and Joanna Briggs Evidence Based Practice with key word searches such as: arterial line, arterial catheter, arterial pressure monitoring, central venous catheter, pulmonary artery catheter, CVC, PA Catheter, invasive lines, pressure lines, complications, studies, research, comparison, differences. Only a half dozen articles proved to be of any use in this review.

Review of the Literature

Hentschel, Wieschoolek, Von Lengerke, Harms, & Jorch (1999) studied the associated complications of indwelling arterial and central venous catheters. In this study, two controls were used and placed on either an intravenous continuous infusion of heparin (100 IU/kg/day), or Heparin in Normal Saline for arterial or central lines 100 IU/kg/day. Complications of oedema 0 -12%; catheter obstruction 7 - 24%; ischemia 28-40% were recorded in both study groups. Subsequently, no difference was found between using heparin in invasive lines versus peripheral intravenous infusions. A conclusion which can be drawn from this study is that despite using heparin in both an intra-arterial and the venous space, it will not always prevent catheter obstruction.

Zevola, Dioso, & Moggio, (1997) studied the comparison of heparinised and nonheparinised solutions for maintaining patency of arterial and pulmonary artery catheters. Using a null hypothesis which stated that catheter failure rates would not differ between study groups, ie, nonheparinised versus heparinised solutions. Their results showed that failure rates of pulmonary artery catheters were not significantly different between the two groups. For arterial catheters however, the failure rate was significantly different between the two groups and heparin was found to be beneficial in this instance. A criticism of this study was the failure to record the length of time an arterial and/or pulmonary artery catheter was in situ. In a perioperative setting, most pressure monitoring lines are removed prior to discharge from the post anaesthetic care unit, unless a patient is to be discharged to intensive care or a monitored high dependency unit.

Martin, Wiesel, & Beretz (1996) studied the complication of blood clotting the end of the arterial line catheter. An animal study, rats were implanted with four catheters, one of which was used to monitor blood pressure for 6 hours. Catheters were filled with 100 IU/ml heparin in saline. Using this standard protocol, approximately 50-200 IU of heparin were injected into the animals. This induced significant anticoagulation. The activated partial thromboplastin time (APTT) increased from 27 seconds to more than 240 seconds.

In light of this, a modified low heparin protocol was devised whereby 0.1 IU/ml of normal saline was implemented and the pressure transducer was back-perfused with saline solution without heparin. This latter measure was not well elucidated on, as potentially the rat (patient) would receive normal saline for the first few hours post arterial line cannulation. This would then be followed by the low heparin solution. Subsequently, the authors found that no significant modification of the APTT was observed, indicating that only trace amounts of heparin were injected. Furthermore, the incidence of catheters clotting off, was found to be the same as the high heparin infusion protocol.

Kulkarni, Elsner, Ouellet, & Zeldin (1994) examined the effects of heparinised saline versus normal saline in maintaining patency of radial artery catheters. This study is most applicable to the perioperative area as the patients were admitted to the surgical intensive care unit requiring an arterial line for surgery. A sample of 78 adults, randomised according to date of admission either received heparinised normal saline (2 IU / mL), or normal saline solutions. The type solutions did not adversely affect the radial artery or the hand in any measurable way. Catheter blockage occurred in three patients receiving heparinised saline and seven patients receiving normal saline as the flush solution ($p = 0.06$). At 96 hours of cannulation, 92% of the catheters in the heparinised saline group were patent compared with 74% in the normal saline group. Their conclusions were that there was no significant difference between flushing with normal saline and heparinised saline in the maintenance of arterial line patency. However, the use of a continuous heparinised flush solution in pressurised arterial lines is beneficial in that it results in greater accuracy of blood pressure monitoring than a normal saline infusion.

Randolph, Cook, Gonzales, & Andrew's (1998) studied the effect of heparin on duration of catheter patency and on prevention of complications associated with use of peripheral venous and arterial catheters. The article, a critical appraisal and meta analysis of 26 randomised controlled trials that evaluated infusion of heparin intermittently or continuously. Results showed that low dose heparin through a peripheral arterial catheter prolonged the duration of patency compared with a solution not carrying heparin.

Current Practice in Major Metropolitan Hospitals (Intraoperative)

	Concentration of Heparin (IU) to Normal Saline + Volume	
Hospital	2001	2004
Cabrini	2 : 1 (1000mls)	2 : 1 (1000mls)
St Vincent's Public	1 : 1 (500mls)	1 : 1 (500mls)
St Vincent's Private	2 : 1 (1000mls)	Normal Saline
Mercy Private	Normal Saline	Normal Saline
Epworth Private	1 : 1 (500mls)	1 : 1 (500mls)*
The Avenue Private	1 : 1 (1000mls)	2: 1 (500mls)
Royal Melbourne	2 : 1 (1000mls)	1 : 1 (500/1000mls)
The Alfred	1 : 1 (1000mls)	1 : 1 (1000mls)
Royal Women's	2: 1 (500mls)	2: 1 (500mls)
Monash	Normal Saline	Normal Saline

* Anaesthetist Preference can dictate the exclusion of heparin.

Some hospitals surveyed used pre-prepared bags of heparin in normal saline like Cabrini, whereas others required the anaesthetic nurse to prepare the bag.

Manual Preparation Method

Human Resource Component:
Drawing up the drug.
Adding heparin to a bag of normal saline.
Completing a drug additive label.
Secondary check with another registered nurse

2 - 5 minutes in duration	61 cents - $ 1.50

(Depending upon seniority of nurses performing the check / preparation)

Materials:

Heparin ampoule $1.48
3ml syringe ($6.10/100) 6.1 cents
19g needle ($3.24/100) 3.24 cents

Drug additive label ($10.92/200) 5.46 cents / label	$ 1.63
Total Additional Cost per line	$ 2.24

Equation of cost per year:

Number of invasive lines required per day averages	10
Five days per week (not including weekends)	(5)
52 weeks a year	(52)
Price difference per line	$ 2.24
Potential Saving per year	$ 2585.18

Recommendations

When making a recommendation which can have both positive and negative consequences, a balance has to be drawn between clinical research, potential complications, monetary differences, and current practice both at this hospital and other major metropolitan tertiary institutions.

To summarise a case against heparin in invasive lines, a common theme of the literature states that short term in-dwelling times will not be affected by the presence or absence of heparin. Potential complications are far greater and more serious if heparin is used. Also, the cost of using heparin in invasive lines equates to a minimum of $2,585.18 up to $15,886 per year, depending upon the preparation method. Conversely, the continued use of heparin in invasive lines by most major hospitals of Melbourne, may be used as a benchmark for current standards of practice in a court of law. The long-term use of invasive lines shows greater accuracy and decreased clotting of the catheter tip. Consequently, in light of these facts, the final decision will have to be decided by medical management as no clear delineation can be made by this review.

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