Editorials

Cognitive development of the intensivist

"Well how come everybody else does one thing and you do another" one smart-aleck trainee at the back of the room retorted, bringing a chuckle from the class.

"Well, I have not found that" I responded. "All my informed colleagues seem to do what I do. You see if a thousand people decide to do a dumb thing it doesn't alter the fact that the decision is still a dumb one".

It was a long day, I was tired and was trying to get the class to review their practice on the use of inotropic agents - what was the evidence? Do they reduce mortality? Unfortunately, I had now surrendered to the primitive instinct of repartee.

I gathered my thoughts. "What I am trying to do is to teach you to think. That means: not doing what I do, not doing what other people do, but doing what you should do after careful consideration of all data. Always question dogma". The class looked disinterested, they wanted facts, thinking appeared to be just too hard.

The session finally came to a close. After more than 30 years teaching intensive care trainees, this was my last tutorial. To some extent I was relieved, although I was still left wondering about the cognitive development of the intensivist. How should one teach intensive care trainees? What is the difference between brain washing and reasoning?

While critically ill patients may present with a simple system failure, they often have complex clinical problems. The disease may appear to be straightforward (e.g. ARDS, acute renal failure), yet the underlying cause may be one of many (e.g. aspiration, pancreatitis, gut perforation, etc) and the patient may have many co-morbidities (diabetes, chronic renal failure, cirrhosis, COPD, disseminated adenocarcinoma, etc). It seems to me that there is a compelling need to have the management of these patients carefully considered.

The novice intensive care trainee is often prone to protocolise patient management. Uncertainty, particularly early in their career, is not tolerated, and there are guidelines for shock, acute respiratory failure, oliguria and the like. To them there are either right (good) or wrong (bad) decisions.[1] Treatment is easy. Just follow the arrows.

However, inevitably they find that decisions often need to be made in the face of uncertainty and patients do not always respond as they should to the various algorithms.[1,2] Ultimately, the early dualistic (right/wrong) approach, gives way to the realisation that there may be more than one way to successfully manage a critically ill patient. Moreover, trainees soon discover that their mentors and 'landmark' articles are not infallible. Facts change. Eternal truths appear to be elusive.

Despite using the same body of evidence in databases (e.g. MEDLINE and The Cochrane Library), recommendations on the same disease often differ as the data can be interpreted in many different ways.[3,4] Often the differences in opinion of those writing guidelines from the "evidence" relates to the extent to which the evidence obtained from selected populations of patients can be extrapolated to the general population. There may also be hidden biases (even from specialists in evidence-based-medicine) that only emerge with provocation.[5]

Medicine is a probabilistic science that sometimes exhibits elements of chaos with the behaviour of disease and its response to therapy unable to be predicted exactly.[3,6,7] Chaos describes a non linear dynamic system with no absolute predictability, and has little utility for the practitioner, who needs some degree of predictability to manage patients. However, the non-predictability of chaos appears to be only important the longer one observes the system. While the effect of a butterfly wing in Rio may lead to a storm in New York, using this argument it seems that a similar occurrence in Rio may also alter the orbit of Pluto - but both must be over different periods of time. Over short periods one may predict events with reasonable certainty, using pragmatic rules and formulae. For example, when we resuscitate a patient we know that one litre of blood over 30 minutes will elevate the blood pressure in a hypovolaemic patient. However, we do not know what the effect will be after a fortnight, but does it matter? We frequently monitor and intervene to alter this system and avert disaster if, after time (in the above case), it looks as though the patient is becoming hypovolaemic again or, on the other hand, developing pulmonary oedema.

While the intensivist's cognitive, affective and psychomotor domains all need to be developed, the trainee has to be able to tolerate ambiguity, with an ability to explore more than one interpretation of the findings.

The teacher should also teach the trainee how to think and not what to think.

"A good question is never answered. It is not a bolt to be tightened into place but a seed to be planted and to bear more seed toward the hope of greening the landscape of the idea"

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Ethical considerations in determining eligibility for expensive technology: The intensive care perspective

Modern biomedical ethics emphasises moral principles that influence decision-making in the health-care delivery arena.[1] These principles affect the course of management of individual patients as well as impact on society as a whole. Implicit in the practice of medicine is the physician's obligation to act in the patient's best interests (beneficence), inflict no harm (non-maleficence), distribute care to all based on need (distributive justice) and respect the patient's individuality (autonomy).[2]

Autonomy, from the perspective of an individual, is a term that expresses the fundamental freedom of a person to choose and conduct one's own life according to his/her morality independently and without external constraints. An autonomous person feels and acts according to mores and rules he has chosen and creates his own agenda for life. Such autonomy is not absolute since it is moderated by societal mores and legal restraints that ensure that individual autonomy will not infringe on the autonomy of others or on society. Clearly, autonomy is a relative term ranging from some individuals having total autonomy, to the child, mentally ill or retarded who have limited meaningful self-determination, to the infant or comatose patient who exercises no autonomy.[3]

Respecting the freedom and autonomy of one's fellow man is considered normative behavior in most societies. In the administration of health care autonomy takes on a further dimension.[4] If autonomy represents self-determination and the right to live a full, healthy, physical and emotional life then ill-health must be perceived as an impediment to such a goal. Even the most trivial of ailments or injuries deprive an individual of his autonomy, albeit often temporarily, and the overall purpose of health care provision should be to restore and create autonomy. Medical intervention not only serves to mend a barrier to restriction but also allows one to continue life's pursuits without hindrance enabling productivity and psychological stability. It is in this context that the patients see help and the physician and health care providers by virtue of their specialised knowledge and expertise participates in this privileged relationship

The restoration and creation of physical and emotional autonomy to persons who have lost their independence via reasons of ill health has always been the primary force driving persons to enter health care professions.[5] Physicians in their daily pursuit of "doctoring" interact principally with one patient at a time and their primary focus and responsibility is towards this individual.[6] Their fiduciary duties include providing honest, timely, intelligible and relevant information to their patients so that they may make decisions relating to their care, keeping promises, maintaining confidentiality or acting in any manner that enhances the moral interests of the patient. Family members, friends, professional colleagues and unidentified members of society are affected by individual management decisions. While consideration of other patients or society is ethically correct, these concerns are indirect. Ethical conflicts arise when respecting individual autonomy clashes with the allocation of limited resources.[7]

The inexorable explosion of biotechnology and its promise to improve health and extend life beyond horizons seemingly impossible just a decade ago has become a major driving force in our understanding of disease and how it can be overcome. New improved devices are replacing the old and biologic therapies targeted at specific molecules (cytokines, coagulation factors etc.) are being developed. For example, the implementation of TNF alpha blocking agents in the management of rheumatoid arthritis (RA) has made an

inarguable impact on the lives of the individuals receiving them.[8] In addition to significant clinical improvement, joint destruction and physical disability, often the inevitable consequences of this devastating disease have been ameliorated and prevented. Unfortunately such advances are not without cost. The annual cost of the three most widely used TNF alpha blockers (infliximab, etanercept and adalimumab) for RA is US$12 - 15,000/patient.[9] This is in contrast to, the very much cheaper (US$ 300 - 500/yr including monitoring costs), of low-dose oral methotrexate (15 - 20 mg) the mainstay of modern RA management. Allocating TNF drugs to all RA sufferers (0.5 - 1% of most populations studied) although noble and in the spirit of restoring autonomy is not economically feasible. If one examines more closely their cost effectiveness based on the degree of response, then the financial implications of providing these cutting-edge therapies increase exponentially.[10]

Similar scenarios are being played out in other areas of medicine including gastroenterology, dermatology, hematology, cardiology, oncology and intensive care, to name but a few.[11] Government health policy makers as well as public and private insurance institutions are scrambling to find a working compromise between providing modern state-of-the-art medicine and at the same time make it affordable and available to those who will derive most benefit.

Ethical issues are abundant.[12] Who should be entitled to these expensive new treatments and devices? By what criteria should policy makers and health services providers be guided? Should overall potential benefit be the major determining factor or should age, social productivity, gender, race or cost be considered?[13] Where government funding (from taxes) and allocation is inevitable are those non tax-paying individuals without residency or citizenship status automatically excluded? Maybe the fairest, if not the most effective, way of distributing an expensive resource is on a first come first served basis or by lottery. Should any of these considerations have any bearing or even priority over potential benefit? Who should decide? It has been argued that social values may need to be considered when allocating livers for transplantation, a limited resource in of itself, to alcoholics or drunk drivers.[14] In the not too distant past entitlement to dialysis treatments were decided largely by committees on the basis of social worth, education and ability to pay. The discrimination, corruption and inequality of this system were socially abhorrent until abandoned by the US congress in 1972.

The intensive care setting, where individuals are often on the brink of death and their very existence is threatened, provides a most challenging arena to examine the conflicting principles of respect for personal autonomy, beneficence, distributive justice and the pursuit of therapeutic goals.[15] Maintaining constant patient sensitivity while adhering to strict acceptable ethical standards of practice can be extremely demanding.[16] The admission of a patient to an ICU and "hooking him up" to monitors, machines and devices as well as inserting lines and tubes into all orifices has an ethic and a culture of its own.[17] Maintaining vital signs, blood pressure, pulse, urine output etc. become goals in of themselves. Success is measured in correcting an electrolyte disturbance, controlling fever, improving oxygenation or resolving a complicated acid-base problem. Although important in alleviating the ravages of disease and attaining a meaningful outcome such instrumentation is often at the expense of individual autonomy and unabated suffering. The urgent medical circumstances surrounding a critically ill patient, the complexity of concomitant active medical problems and the rapidity with which clinical conditions change, dictate an almost constant on-going re-evaluation in concepts and management and weigh heavily on the intellectual, physical and emotional burden that is born by the treating physicians and, indeed, the entire medical team.[18] The very intensity of ICU medical delivery tends to blur the boundaries between beneficence and non-maleficence. Consequently, intelligent, honest, timely information is difficult to deliver and difficulties in communication affect patient care adversely.[19] Consent, the legitimate expression of patient autonomy, often is given (or not given) by next of kin. Patients, their families and members of the medical team lose perspective and sight of meaningful goals of therapy, display frustration and entrench themselves in unreasonable expectations.[20]

The past two decades have witnessed the escalation of the direct and indirect costs incurred in providing high quality health care and its strain on the budgets of governments.[21] Medical care during the last six months of life and the indiscriminant use of medicines, devices and technology in intensive care units are at the head of the list of potential culprits. Macro allocation of finite resources necessitates placing limits on personal gain for the common good.[22] Communities have shared needs, finite resources and mutual goals and define their ethical boundaries accordingly.[23] In this regard health issues may be on an equal standing with education, transportation, security etc. Political activism and special interests play important roles: the relative allocation of resources is a reflection of the priorities given by society to each area. In the ideal scenario this process is transparent and supported by the majority of the community.

How, and by whom should resources be allocated in health care provision? Physicians are in the unenviable situation where on the one hand they are responsible

members of the community and thereby obligated to preserve communal resources while at the same time have a binding covenant with an individual suffering patient to provide unconditional medical care. How can he/she be the servant of two masters?[24] The physician' duty is to the individual patient and not to unidentified strangers in society. However, at the policy making level the community expects physicians to advice, educate, participate and provide guidance in their particular area of expertise. The ultimate goal is to balance patient needs against the needs of society. Rationing at the bedside and in clinical practice occurs all the time. Although doctors can be asked to enforce communal directives concerning health care they cannot play the role of gatekeeper as it only serves to erode the physician/patient relationship. Professional medical societies are required to prepare and update guidelines of care for physicians in the community.[25,26] This particularly true in providing care in the intensive care setting Participation by physicians and indeed all providers of critical care is mandatory in order that finite expensive therapies can be distributed on an equitable basis.

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Unravelling the ethical rules and regulations for research in Intensive Care Medicine

The challenges in conducting high quality human

research are substantial. These challenges include:

1. the development of plausible hypotheses and research concepts,
2. developing a scientifically-rigorous protocol, with attendant focus on statistical power and validated end-points,
3. collection and collation of data relevant to the primary hypothesis,
4. sound and robust statistical analyses, and finally
5. presentation and publication of the study with honesty and integrity.

These principles apply equally to all forms of research, from large-scale randomised controlled trials to qualitative studies.

Underpinning these principles is the requirement that human research be conducted in accordance with international and national ethical standards. These standards are primarily designed to safeguard the wellbeing, privacy and dignity of the patient, and to ensure that human research is conducted in accordance with contemporaneous societal norms. Consequently, the ethical "rules and regulations" under which investigators conduct their research are constantly changing, so that investigators are often faced with increasing bureaucratic requirements. The time investment to complete all of these requirements is substantial and invariably adds significantly to time-lines and costs of projects. Studies may be further delayed if ethical clearance is required from regulatory authorities such as Guardianship Tribunals. Not surprisingly, ethical clearance is frequently a source of frustration for investigators.

Furthermore, research in critically ill patients presents a unique set of ethical challenges. Foremost amongst these is the increasing requirement that all patients give informed consent before inclusion in a study, particularly for interventional trials. By nature of the illnesses that bring patients to the intensive care unit, this is usually impossible, as many patients may be rendered mentally incompetent by the underlying disease or associated treatment. Provision for "delayed" consent from the patient or surrogate or "waived" consent have been employed in these situations, but there is an increasing expectation that unless there is *a priori* patient consent, then participation in a study is not permissible. Such legislation is currently before parliament in the United Kingdom that may make future research in Intensive Care Medicine in that country near impossible.[1]

In Australia, initiatives outlined by the National Health and Medical Research Council offer some promise towards the establishment of a national ethics form and co-ordination of ethical clearance of publicly funded multi-centred trials.[2] Until these initiatives become formalised, ethical clearances remain largely the responsibility of the investigator and the local institutional ethics committee. In order to summarise an increasingly voluminous and complex body of rules and regulations, the Australian and New Zealand Intensive Care Society Clinical Trials Group (ANZICS CTG) commissioned a project to provide a user-friendly summary document of current ethical clearance requirements.

It is with great pleasure that the first edition of the Ethics Handbook of the ANZICS CTG appears in this edition of *Critical Care and Resuscitation*.[3] This document has also been published as a stand-alone document. Amanda Rischbieth and David Blythe have collated, compiled and summarised all of the relevant international, national and state documents that pertain to conducting research in critically ill patients in Australia and New Zealand. This is a truly remarkable effort, and apart from providing an easy reference to nearly all the relevant documents, the handbook also provides useful guidelines and sound advice for submission of ethics clearance documents and the requirements for qualitative research and quality assurance activities.

This handbook, and subsequent editions, will become compulsory reading for all potential, current and future investigators and an essential addition to all intensive care unit libraries, particularly in Australasia, but also around the world.

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Acute renal failure after cardiac surgery in children

Information on acute renal failure (ARF) in children after cardiac surgery is scant. The reported incidence

ranges from 3%[1] to 8%.[2] The range at least partly reflects differences in definitions of ARF.

The most common causes of ARF post cardiac surgery are low renal perfusion during or after extra-corporeal circulation and cardiac dysfunction. In some studies sepsis,[3] and (in adult studies) nephrotoxic drugs also play a role in ARF development after cardiac surgery.[4] The mortality is high, ranging in children from 38%[5] to 91%.[6] Death occurs because of intractable low cardiac output, sepsis or multiple organ failure, rather than the renal failure *per se*.[3] Mortality from ARF occurring after cardiac surgery is much higher than from ARF from other causes.[7,8]

Peritoneal dialysis is the modality of renal replacement therapy that has been most commonly used. Frusemide infusions have been used to maintain urine output as the mortality of non-oliguric renal failure is less than oliguric renal failure.[3] However, differential mortality rates based on urine output reflect differences in severity of the underlying renal injury and overall disease processes. There is no evidence that loop diuretics protect renal function or prevent death in children with renal dysfunction.[9,10] Many units use early peritoneal dialysis for fluid removal rather than for the management of established ARF.

The few reports of long-term renal function in survivors of ARF after cardiac surgery (Table 1) suggest persisting abnormalities of renal function in many children.[1-3,5,6,11,12] Children with ARF following cardiac surgery should be monitored for long-term problems, such as hypertension, which is known to be common in children with other causes of ARF.

The pilot study by Skippen *et al*,[13] in this issue is one of the largest studies performed looking at the epidemiology and outcome of acute renal failure in children after cardiac surgery requiring cardiopulmonary bypass. They found an 11% incidence of acute renal injury but only a 1% incidence of ARF (the patient did not require dialysis). This is much lower than the reported 3 - 8%, however stricter definitions have been applied in the current study.

The Skippen *et al,* paper provides interesting information, but it is a pilot study from a single centre. Much more still needs to be learnt about renal function after cardiac surgery, probably focusing on high-risk groups such as neonates and young infants, and those undergoing prolonged extracorporeal circulation. Strategies to prevent ARF and the complications of multiple organ failure associated with ARF might reduce mortality.

Table 1. Studies of acute renal failure after cardiac surgery in children

Study	*Country, year*	*Number*	*Incidence*	*Mortality*	*Comments*
Medina Villanueva A, *et al*.[12]	Spain, 2004	4 post-cardiac surgery out of a report of 14 with ARF	2.5% incidence of ARF in all PICU patients	36% of all children with ARF	Mortality in ARF in PICU due to multiple organ failure
Kovacikova L, *et al*.[1]	Slovakia, 2000	38 children after cardiac surgery patients	38/1246 children after cardiac surgery (3.0%)	58% (22/38)	Mortality due to intractable low cardiac output
Romao JE Jr[3]	Brazil, 2000	15		60% (9/15)	Mortality due to low cardiac output syndrome ± sepsis
Arora P, *et al*[6]	India, 1997	11		91% (10/11)	ARF associated with 3 or 4 major organs failing
Alarabi AA, *et al*.[5]	Sweden, 1994	8		38% (3/8)	
Shaw NJ, *et al*.[11]	United Kingdom, 1991	34		68% (23/34)	
Gomez-Campdera FJ, *et al*.[2]	Spain, 1988	14	9.0% (14/156)	57% (8/14)	

PICU = Paediatric intensive care unit, ARF = Acute renal failure

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