2010 Trauma Association of Canada Presidential Address: Why the Trauma Association of Canada Should Care About Space Medicine

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Abstract: The Trauma Association of Canada is now 27 years old, having been officially founded in 1983, at the meetings of the Royal College as a maturation of the trauma committee of the Canadian Association of General Surgeons. The first page of the official minutes also stressed the need to welcome other disciplines into the fold. Personally, it has taken me years of involvement, as well as the Presidency, to truly appreciate the depth of our Founding Members commitment. These individuals set lofty mission goals for the organization, namely: to strive to improve the quality of care provided to the injured patient, including prehospital management and transport, acute care hospitalization, and reintegration into society; to support, conduct, and apply basic science and clinical and outcome research related to trauma; to encourage effective and efficient use of healthcare resources in the delivery of trauma care; and to foster professional and community education in the field of injury prevention and in the care of the injured patient. As daunting as these responsibilities are, I am suggesting one more: to overcome the great penalty of geography that challenges our nation and penalizes many of our citizens by aspiring to optimize these four goals, for all Canadians, irrespective of where they live—our potential fifth mission. Furthermore, I believe that lessons from space medicine may offer some strategies to accomplish this goal.

Key Words: Surgical procedures, Weightlessness, Critical care, Ultrasound, Telemedicine.

The Trauma Association of Canada (TAC) is now 27 years old, having been officially founded in 1983, at the meetings of the Royal College of Physicians and Surgeons of Canada as a maturation of the trauma committee of the Canadian Association of General Surgeons. The first page of the official minutes also stressed the need to welcome other disciplines into the fold. Personally, it has taken me years of involvement, as well as the Presidency, to truly appreciate the depth of our Founding Members commitment. These individuals set lofty mission goals for the organization, namely: to strive to improve the quality of care provided to the injured patient, including prehospital management and transport, acute care hospitalization, and reintegration into society; to support, conduct, and apply basic science and clinical and outcome research related to trauma; to encourage effective and efficient use of healthcare resources in the delivery of trauma care; and to foster professional and community education in the field of injury prevention and in the care of the injured patient. As daunting as these responsibilities are, I am suggesting one more: to overcome the great penalty of geography that challenges our nation and penalizes many of our citizens by aspiring to optimize these four goals, for all Canadians, irrespective of where they live—our potential fifth mission. Furthermore, I believe that lessons from space medicine may offer some strategies to accomplish this goal.
Trauma Care in Arctic Canada

Aboriginal (First Nations) people in Canada suffer disproportionate rates of traumatic injury and critical illness, reported as 6.5 times higher when compared with the Canadian average (and being even worse in some jurisdictions).\(^2\)\(^-\)\(^4\)

The Inuit, typically inhabiting the most remote areas of Canada, have the lowest life expectancy among Canada’s three aboriginal groups and have a 12-year to 15-year shorter lifespan than most Canadian, and the further North they live, the shorter their life expectancy.\(^5\)\(^,\)\(^6\)

The potential reasons for this are complex, involving an interplay of social, economic, geographic, and logistical factors. The Canadian Broadcasting Corporation recently reported that one in five First Nations adults do not see a doctor or a nurse over the course of a year.\(^7\)

Thus, some have labeled the medical care in the North as being fourth world, a definition that captures the state of subpopulations that are both culturally and geographically isolated.\(^8\)\(^-\)\(^10\) This occurs despite the fact that on the surface, Canadian primary healthcare services are well financed and seem to be among the best in the world.\(^6\)

However, despite some laudable achievements in reducing infectious disease mortality, Inuit and Indian populations exhibit mortality in excess of even many of the poorest third world countries.\(^6\)

Although the determinants of the First Nations health outcomes are extremely complex and multifactorial, geography and transportation are clearly major challenges. Independent of race or ethnicity, patients injured in rural settings are greatly penalized, with a greater than 50% increased mortality after motor vehicle crashes,\(^11\)\(^,\)\(^12\) and have worse functional outcomes.\(^13\)

Deaths from all injuries for males and females were four times higher per capita in the North West Territories and Nunavut, compared with Ontario (Fig. 1).\(^14\)

Nearly half a century of research has shown that consolidating expertise at geographic sites known as trauma centers improves outcomes.\(^15\)\(^-\)\(^18\)

However, Hameed et al.\(^19\) have shown that 20% of Canada lives beyond the “golden hour” from a trauma center and that, realistically, the North, comprising 41% of our land mass, lacks reliable access to definitive trauma care.

Corollaries Between Remote Trauma Care and Space Medicine Trauma Challenges

Many of these challenges faced by inhabitants of the isolated remote regions of Canada are comparable with those faced by astronauts once they leave our planet’s surface. There are environmental extremes, limited onsite care, restricted communications, periods of nonevacuation, and dangerous transport conditions just to name a few.\(^20\)\(^-\)\(^23\)

In essence, space medicine and TAC are attempting to address many of the same challenges. Unintentional injuries continue to be the leading cause of death from ages 1 year to 34 years,\(^24\) the overall second leading cause of preventable lost years of life,\(^25\) and the highest ranked condition of concern for space medicine considering the probability of occurrence versus the impact on the health of the crew and the mission itself.\(^26\)

Space is dangerous and involves construction. Massive objects are easily set into motion, and although they have no weight, they still have injuring force as described by classic physics (force equals mass multiplied by the acceleration of an object).\(^20\)\(^,\)\(^22\)

International Space Agencies and the Global Exploration Strategy

Space agencies around the world, especially the Canadian Space Agency (CSA), have well noted these similarities, and a major goal of the CSA mandate is to advance medical care for remote Canadians.\(^27\)

In May 2007, 14 international space agencies adopted a Global Exploration Strategy, signifying a new era in cooperation for exploration beyond low earth’s orbit.\(^27\)\(^,\)\(^28\)

In December 2008, the CSA defined specific Canadian contributions, in which Operational Space Medicine was identified as a particular Canadian strength,\(^27\) with five overall objectives, of which two are particularly pertinent to both TAC and the University of Calgary (UofC). These are diagnostic and treatment technologies and telemedical support.

Currently, the next leaders in space exploration are yet to be determined; will it be National Aeronautics and Space Administration (NASA) with a redefined goal to visit Mars by now collaborating with private industry rather than competing? President Obama just stated his belief that humans will venture to Mars in his lifetime.\(^29\)

Or will it be China, who are ever progressing or private industry noting, for instance, that a private company, Bigelow Aerospace, actually has two inflatable spacecraft in orbit right now in a serious effort to create a space hotel industry.\(^30\)

However, no matter who leads, ultimately, the human species has a destiny to explore and colonize beyond our planet. Unfortunately, it is the human crews that will likely be the weak link of the operation and will require medical care.\(^20\)\(^-\)\(^22\)

Throughout the history of exploration, human failures rather than transportation system failures have been more common.\(^21\)\(^,\)\(^31\)

Figure 1. Combined injury rates for both sexes all ages year 2000 in Canada.
The Calgary Space Medicine/Surgery Research Initiative

The trauma service in Calgary has had the privilege of pursuing space medicine research and, more importantly, terrestrial spin-offs for many years. As a brief overview, the scientific study started modestly in the late twentieth century by comprehensively reviewing the trauma in space literature and identifying questions regarding the potential use of ultrasound in weightlessness.32,33 We thereafter partnered with NASA in the weightless research environment of parabolic flight to explore these questions.33–39 These studies were productive both for space and terrestrial medicine and were subsequently followed up in a number of directions. These included the terrestrial spin-off and study of ultrasound techniques originally envisioned for space diagnosis,40–46 further space-analogue evaluations of the basic physiology and technical requirements for space interventions,47,48 and, most importantly, terrestrial evaluation of the concepts of remote-guided telesonography, both on the International Space Station (ISS),49–51 and here on the earth.52–54 In fairness to the great vision of Scott Dulchavsky, the UofC group has had little involvement with ultrasound onboard the ISS, hence, the most correct dashed line reflecting the overall programmatic structure of the UofC Trauma Services Program (Fig. 2).

Ultrasound in Weightlessness

The original studies in 2000 looked at the possibility of using ultrasound in weightlessness because it was and is still the only imaging modality in space; there is no X-ray, computed tomography, or magnetic resonance imaging.35,36 Although the ground laboratory test was conducted in Vancouver, the most interesting research was done onboard the KC-135, an aircraft capable of generating up to 30 seconds of weightlessness by flying a ballistic or parabolic profile.38 This project reconfirmed that almost any procedure, including ultrasound can be performed in weightlessness as long as the investigator is prepared and the operator, patient, and equipment are restrained.35,36,46 Most importantly, however, it demonstrated the power of ultrasound as a tool for answering clinical questions in real time, no matter what the environment.

Terrestrial Applications

It, thus, seemed natural to assess novel and nontraditional indications for point-of-care ultrasound back in the terrestrial setting where many more patients might potentially benefit. Thus, many of the same investigators from the parabolic flight studies directed their own clinical teams to examine the “outside the box” ultrasound applications from weightless in their terrestrial practices.42,43,55–59

The Canadian Gasless Laparoscopy in Weightlessness Studies

In addition to ultrasound, the group also examined weightless surgical procedures back in 2000.39 Realistically, surgery in space should be avoided if possible by preventing or prophylaxing, evacuating to earth early, or treating surgical conditions either nonoperatively or percutaneously.60,61 Unfortunately, if humans venture many years from earth, there are many reasons why they will be at greater risk for emergency surgical conditions or trauma than even on earth.20,21,62,63 Physiologic concerns regarding long-duration space flight include but are not limited to immune dysregulation and potentially inherently more virulent microbes.22,23,64 Although providing care involves a very small number of patients, learning the basic science, technology, and conduct of surgery in such challenging environments has much to teach us regarding care back on earth. Further, I believe that just embarking on such a project attracts our most talented colleagues and stimulates our trainees. An example of such a project is the Gasless laparoscopy in weightlessness project conducted in March 2007, reflecting the cooperation of academic, government, industry, and military collaborators.

In addition to the usual perceived benefits of minimally invasive surgery, in space, there are additional potential benefits in terms of keeping the cabin environment cleaner and returning the crewmember to duty sooner.32,39,62 Contrary to original predictions, the ability to perform laparoscopy in weightlessness is no more difficult than in 1g.39,62 Further, the abdominal cavity had anecdotally been reported to change from a flattened oval to a more round shape creating, more surgical domain to operate within. However, before simply accepting that laparoscopy is appropriate for space, the issue of intra-abdominal hypertension (IAH) and its attendant physiologic penalties need consideration. There are many questions as to whether an injured astronaut could tolerate the stresses caused by insufflating gas under pressure required to perform standard laparoscopy.21 Clinicians in general and especially the World Society of the Abdominal Compartment Syndrome recognize that increased intra-abdominal pressure has adverse affects on nearly every organ65 and go to great lengths to avoid this.56,67

We, thus, speculated that “abdominal wall lift devices” might allow us to perform minimally invasive surgery without gas insufflation. These devices were introduced on earth over a decade ago68,69 but never achieved widespread acceptance.70 It was hypothesized that this technique might work better coupled with the spontaneous abdominal wall changes that occur in weightlessness.

Figure 2. Schematic overview of the Calgary Space Medicine Research Program.
To proceed, a weightless laboratory, meaning parabolic flight, was required. Although NASA’s Vomit-Comet is famous, most Canadians do not know that the National Research Council of Canada also runs a parabolic flight program based at the Flight Research Laboratory (FRL) at Uplands Airport in Ottawa, using the Falcon 20 Aircraft (Fig. 3). In addition to the actual weightless flights, the FRL and CSA provided familiarization for the novice team members, involving formal lectures and brief introductory parabolic flights, so that each individual’s tolerance to varying gravity could be understood.

The Modular Critical Care Resuscitative Surgical Suite

Another great challenge was that there are no compact surgical platforms in existence that fit within the confines of the Falcon 20, which is limited by a physical space of 1.5 by 1.5 m. Thus, the FRL engineering and design team disassembled the standard hardware and equipment from veterinary critical care and surgical suites and then reconfigured it to fit on the Falcon. The platform was designated as the Modular Critical Care Resuscitative Surgical Suite (MCCRSS), which we perceive as unique. The MCCRSS satisfied many structural, informatic, anesthetic, and surgical challenges presented by doing surgery in a small aircraft, all packaged within a small footprint of a 36 by 36 by 19.5-inch frame. The resuscitation and anesthetic systems included oxygen, a transport ventilator, three separate IV pumps, and a state-of-the-art multichannel intensive care unit/anesthesia vital signs monitor. The laparoscopic surgery required a video monitor, light source, gas insufflator, and camera. There was a doubly redundant DVD recording capability and compressed medical gases including oxygen for the pig and carbon dioxide for the surgery (Fig. 4). Finally, the fully anesthetized pig was...
secured aboard the platform for flight. The MCCRSS easily fit within the physical confines of the Falcon, so we surmise that, if needed, it could also fit within larger transport helicopters or even our smaller tactical support helicopters. We believe that collocating and bringing together different resuscitative and interventional technologies is the way of the future. Delivering the most critically injured to a hybrid surgical or trauma capable operating room is an example of a new way of performing resuscitation, and correspondingly, Alberta Health Services, in conjunction with the Calgary Health Trust, is building the world’s first dedicated purpose-designed trauma hybrid operative/resuscitative theater in Calgary. Currently, although a mobile robotic hybrid operating room for space flight is just a dream, it is perceived to be a future requirement for a safe mission to Mars.21,60

Variable Gravity Onboard the Falcon 20 Aircraft

Assessing the potential of gasless laparoscopy in weightlessness involved three different abdominal manipulations onboard the Falcon 20. The baseline comparator condition was gasless conditions during which no formal abdominal wall manipulations were conducted. The second distinct state that did involve marked manipulation of the abdominal wall was abdominal wall retraction during which the anterior abdominal wall was physically retracted away from the spine in an attempt to increase the peritoneal laparoscopic domain. The third abdominal condition was standard laparoscopic insufflation at 15 mm Hg, by definition, a state of IAH.66,74

Abdominal Morphology and Surgical Endoscopy in Weightlessness

In-flight measurements confirmed the spontaneous conformational change from a compressed oval to a more circular shape, regardless of whether the abdomen was insufflated or not.48 Despite these spontaneous changes in the abdominal wall dimensions, gasless laparoscopy without retraction was completely inadequate to perform any laparoscopic manipulations or even to visualize the pelvis. This was also dangerous, contributing to bowel injuries with resultant septic shock.75 As an addendum, these complications, in addition to the prolonged anesthetic provided in multiple transport vehicles and various gravitational fields, offered an excellent rationale for reviewing both the veterinary and anesthetic management for space medicine research in general.75

Abdominal wall retraction was variably effective in normal terrestrial gravity. Unfortunately, in weightlessness, despite the increased potential X dimension, the viscera (especially the small bowel) simply floated up to fill the increased space, actually reducing the surgical domain.48,72 As a result, and contrary to the original hypothesis, laparoscopic visualization of the pelvis requires gas insufflation. Even with good viewpoints in 1g or 2g, the pelvic visualization generally improved in 0g.48 Thus, it was concluded that both spontaneous or abdominal wall retracted gasless laparoscopy in weightlessness are not feasible and, therefore, gas insufflation, should remain the standard of care, as it provides good if not better visualization in 0g compared with 1g. Future studies will address the relative levels of positive pressure insufflation that balance the physiologic costs and logistical realities.

Physiologic Penalties of Long-Term Exposure to Weightlessness

The long-duration astronaut suffers many physiologic changes that are akin to the debilitated critically ill bedridden patient.22,76,77 Thus, research to overcome the decompensated physiology of an injured astronaut may offer insights into the care of many-fold more terrestrial patients. Physiologic concerns accompanying long exposures to weightlessness include reduced circulating blood volume, red cell mass, and cardiac function; immunologic detriments; and bone and muscle atrophy.22,78–81 Thus, the Falcon 20 studies also considered the thoracoabdominal interactions involved with weightlessness and abdominal manipulation. Correlating each tidal volume with the abdominal condition, first confirmed that IAH of as modest degree as 15 mm Hg markedly affects tidal volume in normal gravity. More importantly, however, was that simply being in weightlessness nearly offsets this impairment as the abdominal cavity is physically “unloaded” from the thoracic cavity.47

Regardless of the abdominal condition, overall, weightlessness was associated with increased tidal volumes. Hypergravity however, resulted in reduced tidal volumes.49 Further, regardless of the gravitational field, standard gas insufflation was associated with reduced tidal volume, an effect that was much reduced but not obviated with abdominal wall retraction. The most unique points of this initiative, however, were to compare the relative consequences of using these different techniques in different gravitational fields. As expected, introduction of IAH from a CO₂ pneumoperitoneum in normal gravity induces a marked (27%) tidal volume reduction in normal 1g, and this effect was further accentuated in 2g. Weightlessness itself was beneficial in this regard, as tidal volumes in gasless or baseline conditions spontaneously increased just with entering 0g. It was unexpected, however, that compared with gasless in 1g, entering weightlessness itself appeared to protect the lungs from reduced tidal volumes and thoracic compliance, such that there was a nonsignificant change from baseline with insufflation in 0g, even though the peritoneum was now inflated and subjected to IAH.47

Integration and Conceptualization of Space Surgery/Critical Care Findings With Normal Physiology

We believe these changes are congruous with previous studies of pulmonary volumes performed onboard the Spacecab, as long as the supine orientation of the pig is understood. Not surprising, surgeons and physiologists tend not to communicate well with each other. When standing upright on earth, gravity normally unloads the lower lung fields. In general, space physiologists, thus, speak of reduced lung volumes after entering weightlessness. When standing, the functional residual capacity (FRC) decreases on entering weightlessness as the diaphragms are no longer pulled caudad by gravity, and the FRC decreases by ~500 mL.82–86 Compared with this healthy standing adult on earth, weightlessness reduces the FRC, expiratory reserve volume, total lung capacity, residual volume, and inspiratory vital capacity. Induction plethysmography confirms a decrease in the
abdominal circumference related to an inward displacement of the abdominal wall of the erect (1 Gz) human on entering weightlessness.83,87

However, for critical care medicine in space our comparator should be the supine subject, such as a debilitated intensive care unit patient in normal gravity, whose lung bases will, therefore, be less compressed by the abdominal contents in weightlessness than they will be in gravity, causing comparatively increased lung volumes in space. Thus, in onboard the Space Life Sciences-1 Spacelab studies, the average FRC and expiratory reserve volume were 650 mL and 850 mL, respectively, increased over those measured in the 1g supine posture.84 To summarize, IAH induced by gas insufflation markedly embarrassed thoracic compliance as measured by tidal volume changes in 1g, an effect that was accentuated in hypergravity (2g), thus providing construct validity. Conversely, abdominal wall retraction largely preserved tidal ventilation in both normal and hypergravity. Most notably, performing laparoscopy with the normal IAH that accompanies standard gas insufflation impaired the tidal volumes markedly less in weightlessness than occurs on earth. We believe these findings have important implications for the development of surgery in space. It may be that reduced pressure laparoscopy or even standard laparoscopy may be better tolerated than expected. Further, the findings of improved ventilatory parameters may have implications for serious respiratory conditions in space, such as adult respiratory distress syndrome, which are typically worsened by recumbency and IAH on earth.22

The immediate deliverable is potentially better care for a Mars mission because ultimately humans will go to Mars, and we will have to identify the best possible modality of care. Of greater relevance to many more patients, however, is a better understanding of the interactions between thoracic and abdominal pressure and the effects of gravity here on earth. For instance, prone ventilation is often dramatically effective in catastrophic situations,88,89 but despite at least 10 randomized-controlled trials and 5 meta-analyses to reanalyze them, proving efficacy is problematic.90–93 Although the physiology of prone positioning is complex and still debated, it is integrally related to the mechanism of relieving gravity from the lung bases, both to allow increased lung volumes and to remove gravitational flow gradients.91,94–96 We believe that weightlessness has the same benefits, making it an ideal environment to study the interactions between intrathoracic and intra-abdominal pressures without being confounded by positioning and weight, which become irrelevant. In terms of our next initiatives, we hope to study whether there is a hybrid solution wherein partial pressure laparoscopy might offer adequate laparoscopic domain without gravity while still using lower insufflating pressures. We also wish to further explore the true interactions between the chest and abdomen in weightlessness with a hope to learning how to better care for people on earth.

Telemedicine and Remote Telementored Sonography for Guiding Resuscitation

The other important CSA emphasis in space medicine that is particularly relevant to the CSA, TAC, and the UofC is telemedicine, especially in the techniques of remote telementored telesonography.27 The UofC team has greatly leveraged off an ongoing collaboration with the NASA team that have pioneered “just-in-time,” remote-guided telesonography using novice onsite care givers, guided by terrestrial experts. The philosophy recognizes that there is a state-of-the-art ultrasound machine on the ISS as the only potential imaging modality,28 yet, there is typically no physician onboard formally trained to use it. The NASA group has defined this as an emerging discipline of future medicine.49–51,97,98

To evaluate the potential terrestrial applications of this same technology, especially for remote and arctic Canada, the CSA has funded an ongoing evaluation of this concept between the emergency rooms of both Foothills Medical Centre and the Banff Mineral Springs Hospital.52,53 It should be stressed that Banff was chosen because of its geography and referral patterns and because the Banff physicians are already experienced in trauma ultrasound.49 Thus, the project is a test with a view to refining these techniques for use in the high North. Essentially, it links Foothills Medical Centre to the trauma Bay in Banff, wherein a novice user, such as a student who has never used ultrasound before, can be guided by a remote expert, who cannot only see the patient but is also viewing the ultrasound findings real time (Fig. 5).

This research is funded by the CSA, not just to aid Albertans but, more specifically, as a testbed to aid develop the technology and protocols required to use this technology in the arctic. Concurrently, simulated trauma resuscitations from Devon Island in the Northwest Territories to a medical panel of in Calgary were conducted. Devon Island is used by both NASA and the CSA as a Mars surrogate as it is the closest available analog to the red planet on earth.61 The onsite project medical officer located in Devon Island was able to readily communicate real time over satellite with consultants in Calgary, who in turn could follow and guide every step if necessary. Only the future will prove whether this truly helps patients. Sustainability remains a ubiquitous concern.

Figure 5. Resuscitation room in the Banff Mineral Springs Hospital illustrating ultrasound equipment and video-conferencing screen.
challenge for telehealth. Whatever helps us communicate and improves timely diagnosis is a good prognosis for the future however. Although TAC is primarily concerned with trauma care, we also have expanding international health interests and recognize that maternal-fetal health is a massive global problem that would be greatly impacted by readily accessible and timely ultrasound diagnoses. The World International Network Focused on Critical Ultrasound has, thus, identified this as an immediate need with high priority for ultrasound providers.100,101 This technology has tremendous potential, and currently, tele-obstetrical links are being evaluated among Iqualuit, Cambridge Bay, and Rankin Inlet.

Cost-Effective Remote Telementored Sonography

A technology has the best hope for wide acceptance if it is both efficacious but also cost-effective and easily acceptable.102 Thus, one of our newest initiatives is directed at both investigating how simply and cheaply we can provide advanced ultrasound diagnoses to those requiring medical care and exploring how to interact with nontraditional just-in-time healthcare providers of either convenience or “last resort.” Paul McBeth, a surgical resident with additional robotic engineering experience, has shown that 7 year olds can be guided remotely to use ultrasound to demonstrate lung sliding and excellent vascular anatomy over the Internet as you guide them using appropriate vocabulary. This simple system uses a free online social networking system for the mentor and mentee to communicate, with the mentee’s hands and the patient displayed to the mentor by a head-mounted video-camera and a handsfree microphone (Fig. 6A). A telling vignette from one of these sessions was that as the child had no difficulty in manipulating the ultrasound probe to obtain meaningful images (Fig. 6B), the remote mentor forgot who he was mentoring and reverted to typical medical terminology, prompting the child to ask her mother; “Mommy—what’s parallel mean?” This vignette reemphasizes the importance of using or speaking the appropriate language that might be well below the mentors educational level or a different language altogether. With deep extraterrestrial exploration, future considerations might concern guiding providers who might not even be human nor even have hands.

A further initiative to allow just-in-time and point-of-care users to concentrate solely on just following the instructions of the remote experts consists of having a remote ultrasound keyboard that controls the distant machine, thus freeing the user from having to worry about the “knobology” of the machine (i.e., gain, depth, or focus). To this end, initial evaluations have been conducted involving investigators in Calgary and Hamilton controlling the control panel of a remote Ultrasonix ultrasound on Mount Mauna Kea in Hawaii. Collectively, these experiences with telementored sonography continue to reinforce the point that the limiting factors concerning sustainability are the availability of competent referral specialists. The onsite providers want to use this service for their patients, but “experts” typically are not available for them and likely will not be until we establish a national or multinational, potentially virtual center of competent content experts capable of telementoring onsite providers to obtain the appropriate diagnostic information to improve remote patient care. This concept has been championed by Douglas Hamilton, and it is an idea whose time will eventually come. Simply put, this new discipline of telecare specialists needs to have content knowledge, patience, communications skills, and triage experience.

CONCLUSIONS

The TAC is very much a growing and vibrant contemporary organization that is ever increasing its responsibilities and scope in its aims of providing better care for those injured in Canada. There are further ongoing initiatives to extend...
TACs concern to injured people outside of our borders by taking a more international interest in the welfare of humanity through initiatives such as partnering with other societies such as the Australasian and Pan American trauma societies. TAC has also created an International Issues/Disaster Committee led by Tarek Rezak and Dianne Dyer, and introduced an annual international lecture at the annual meeting (Fernando Ferreira was the initial speaker). To continue this trend, I personally look forward to a future, justified by both a need and progress in care, to initiate an extraterrestrial trauma committee of TAC, as it will presumably symbolize the culmination of many medical breakthroughs in helping back on earth. Furthermore, I believe that many of these space medicine breakthroughs will benefit our most remote Canadians, a group who need the special consideration and the increased attention of the TAC now and into the future.

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REFERENCES


