So, You Want To Do Heart Surgery in Mongolia

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Citation

Abstract
After a decade of practicing cardiac anesthesia in an academic center I was overcome with the altruistic need to use my skills in parts of the world that don't benefit from our advanced technology. I was fortunate to be directed to Project Open Hearts (POH) through a new acquaintance at a Wilderness Medicine Meeting. This organization operates world-wide and not only provides cardiac health care on many levels, but also evaluates and teaches during its visits. The adage "teach them to fish and they will eat forever" applies here. As fate would have it, POH was in need of an anesthesiologist for their next mission to Mongolia.

MISSION REPORT

The organization set up our itinerary and made travel arrangements. Rotary Club members provided that all-important diplomatic and troubleshooting assistance along with POH's director. This 21-man team required about six months of planning and equipment gathering to bring this mission to fruition.

As with any remote location it is not always possible to fly directly to your destination. We were required to overnight in Beijing before leaving the next day on Mongolia's airline, MIAT, which only flies to Beijing three times a week.

Figure 1

Figure 2

Figure 3

The mission is more than doing some heart repairs like some automotive repair shop. We can only handle a few cases, but if we teach, repair, replace and provide long term support, this core group of physicians, nurses and technicians can continue to improve their proficiency, thus providing 20th century care with reasonable outcomes.
My enthusiasm was unleashed as I proceeded to help put together part of the team. Unknown to me at the time, my best decision was to recruit a cardiothoracic (CT) surgeon whom I had known for years and not only respected but had developed a lasting friendship that could weather any form of chaos.

My perfusionist was also a friend and could build a bypass pump from PVC pipe and duct tape. I also took along my exceptionally bright and capable CT anesthesia fellow since we weren’t exactly sure what we were going to find when we set up our OR. After all, two heads are far better than one, or so I had been told. The rest of the medical team members included a biomedical technician, critical care nurses, OR nurses, a cardiologist and a very experienced retired cardiac surgeon.

There was something empowering about asking the president of an oil company to search Mongolia for lithium batteries which, by the way, don’t exist there. I, due to a lifetime of personal disasters, feel that every possible scenario needs to be considered and must have the proper tools to deal with it. This philosophy resulted in four large cargo bags of medications, medical equipment, and survival equipment (in case food, water and shelter became an issue or in case we crashed on Mt. Everest on the way) and personal items from toilet paper to makeup. Luckily, my CT fellow had no experience with life outside a major metropolitan center and thus was happy to have her hair dryer on hand.

We brought a vast array of medications, much of which were provided by AmeriCares and pharmaceutical companies. These included everything from digoxin to milrinone to amiodarone. Aside from drugs, we brought enough OR supplies for 12 cardiac valve cases: IV set-ups, arterial lines, central lines, swans, syringes, needles, IV catheters, ET tubes, laryngoscopes, temp probes, etc. A borrowed I-Stat machine with cartridges provided some lab data. An end tidal CO2 device and portable pulse oximeter (the type they use on Mt. Everest climbs) were also brought in the event their anesthesia machine was not so equipped (or in case we crashed on Everest). Translation books and various other informational materials were added to the mix.
Due to the kindness of Air Canada who took pity on these two novice do-gooders with far too much luggage and weight, we were able to take all our “stuff”. One can only imagine the thoughts of the Customs Officials in China as 21 Americans invaded their entry line with about 1,000 lbs. of luggage, looking worn, pale and confused by the absence of any English signs. Every square inch of our hotel was covered by luggage and there was great fear in unpacking anything for our overnight stay lest we not be able to repack successfully.

The following day we flew to our destination on an airline we had never heard of but the U.S. Embassy website referred to as relatively safe. As you can imagine, the plane is filled to capacity and space is at a premium. Our arrival was met with great enthusiasm by our hosts who were befuddled with our expanse of luggage. The van recruited for the awesome task overheated and required hours of slow travel to finally reach its destination.

Another day of traveling over, we were treated to a special welcome dinner at our private hotel—the hotel used for diplomats and visiting dignitaries. This is where the reality of 3rd world existence came crashing down on all of us neophytes. Life in these nations is hard and nowhere near the level of comfort we have come to expect in our country. The lack of creature comforts was made up for ten-fold by the warmth and enthusiasm of the people we came to help.

The next day was designated for unpacking and setting up,
as well as selecting those patients we were going to operate on. We were taken to a wing of the hospital that would be trans-formed from an empty, cold abyss to a stocked area bustling with people from different nations for a common cause. We toured the OR to see what equipment we had to work with. They introduced us to their best anesthesia machine. The look on our faces was priceless and breaking the silence was my fellow who blurted, “Oh, my God, what have we gotten into?”

Figure 10

The machine, Russian, was probably state of the art technology in the 60’s, with no end tidal CO2 monitor or pulse oximetry in sight. We spent the next few hours repairing and safety checking the machine. Ventilator repair failed as noted by an impressive case of stacking in our first patient. Meanwhile, our CT surgeons chose the patients for valve replacement during the week. Since medical information was scanty and at times questionable we made a mental note to bring a portable cardiac ECHO machine the following year. Besides the anesthesia machine, this had to be one of our better equipment decisions.

Figure 11

At the request of the Mongolian team, we watched them do a case without our assistance. Their mortality rate was almost 100% when a bypass machine was used, thus, hypothermic arrest was their primary means of cardiac repairs. The Mongolian surgeons placed an arterial line by cutting down on the radial artery as the anesthesia team did not know how to do percutaneous placement. A cardiologist placed the central line via subclavian, but no swan was utilized. We knew then that our teaching was about to become extensive just for procedures. Our first observation was, as compared with the U.S., that surgeons and anesthesia did not interact with each other. The patient began having ventricular ectopy which didn't seem to stimulate any concern on either side of the table. The patient became unstable and still no discussion or intervention occurred so we left our perch and dove into the case. Halothane and ketamine are their primary anesthetic agents. We placed our monitors and discovered an ETCO2 of 65 mmHG and a pulse ox reading of 91%. Hyperventillation, changing the halothane to the isoflurane we brought, and changing the Soda Lime granules resolved the situation. Evidently the Soda Lime hadn't been changed in five years and was no longer effective. Due to a lack of
oxygen cylinders and low wall oxygen pressure, oxygen was conserved. This resulted in very low and slow tidal volume breaths which were manually controlled by the technician. We resolved the oxygen supply problem by using the anesthesia tech as a manual ventilator, who glued he eyes to the ETCO monitor. The week was filled with the teaching of percutaneous lines, including internal jugular cannulations. We taught the hemodynamic interpretation of Swan numbers from the expensive monitor (seldom, if ever, used).

**Figure 12**

During one of our placements the swan catheter fell on the floor. In the U.S. the catheter would be discarded and replaced with a new one. Here we had no such resources, nor did we have more than five catheters. After staring at the fallen catheter for what seemed to be an eternity, the anesthesia technician picked the catheter up, drenched it in betadine and handed it to the anesthesiologist. After a moment of horror at the thought we realized that every piece of medical equipment was a priceless commodity. We positioned the catheter and made sure significant antibiotics were given. The week was filled with stenotic rheumatic mitral and aortic valves which were replaced by donated mechanical valves. Our surgeons were very impressed with the skills of the surgeons who primarily trained in the Soviet Union.

**Figure 13**

Unfortunately, death is not infrequent to these teams, thus “trouble-shooting” during critical events became one of our primary obstacles to overcome.
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Figure 14

Unfortunate in Mongolia, anticoagulation is expensive and these patients would alternate aspirin with warfarin post op. The following year, we discovered some had developed malfunctioning valves due to thrombus. The team worked on resolving the anticoagulation issue, so we concentrated on coronary bypass surgery both on pump and off. The bypass pump was seldom used until our arrival.

The division of medical specialty eluded us as the perfusionist was also a cardiologist and some of the lower level surgeons also did interventional cardiology. Transporting to the ICU introduced us to a device called the oxygen pillow. This device held about 15-20 liters of oxygen and provided a reservoir of oxygen for our ambu bag.

Figure 15

The ICU turned out to be the most challenging area during each mission. Upon arrival all that was available were five beds, four HP monitors, missing pressure and EKG cables, and a handful of medications. The patient's family was responsible for sheets, pillows and blankets. Also, much to our amazement, they brought food once the patient was allowed to eat.

Figure 16
The same problems that plagued the OR were present in the ICU. The oxygen from the wall units that powered the old Russian ventilators (also repaired by our MacGyver-like biomedical techs) often shut off with no warning sending our nurses scurrying for ambu bags to ventilate the cyanotic post op patients. We discovered that oxygen to the wall units was provided by H cylinders in the oxygen room below the ICU. The technician would wait until the oxygen ran out before he would change the tanks. A backup set of H cylinders was placed in the ICU and used during oxygen “blackouts”. The other challenge was attempting to regulate inotropic and vasodilating drips on nothing more than a dial-a-flow or minidrip. “Ballpark” was the phrase of the day. We never exactly knew the dose but at least we knew if the patients were getting better or worse. Triaging problems in this environment was made easier by experience of the team.

On average most had been practicing their profession for at least 10 years, thus making for better judgment calls with very little data. The nurses worked diligently on teaching post op care. The first rule—take care of yourself. Certain legs of our travel determined the need to upgrade to business class, due to 14-hour flights. On following missions, the first priority was to collect enough frequent flyer points to upgrade the long legs of the trip.

Life in these nations is hard and nowhere near the level of comfort we have come to expect in our country. The lack of creature comforts was made up for ten-fold by the warmth and enthusiasm of the people we came to help. Returning home after a mission brings with it a renewed appreciation of one’s life.
Traveling with narcotics and benzodiazepines required not only personal purchasing using a 222 DEA Form, but had to be accompanied by a formal traveling letter from the mission section of the DEA. Transporting narcotics without this letter puts you in the same category as the Columbian cartel with all the legal ramifications associated, and this only applies while flying in the U.S.—once out of the country you are at the mercy of each individual country. These donated drugs cannot be returned to the U.S., thus, proper delivery and release to the host hospital pharmacy is required with all the appropriate signatures obtained before your return home.

The oxygen problem which plagued the ICU was remedied by the installation of a manifold system with alarms. Donations the following year allowed us to purchase a basic Ohmeda anesthesia machine with a working ventilator. Aside from medications an equipment, everyday conveniences were hard to come by. There is no nearby Radio Shack or Home Depot. Those lithium batteries required good old-fashioned ingenuity—they get a daily transfusion from regular 9-volt batteries.

The second mission actually incorporated a daily structured curriculum which was met with great enthusiasm. We handled emergencies either by in-house M.D.’s or walkie-talkies. We only had one emergency which required a take back for bleeding in the middle of the night. During this event we learned about blood transfusions in third world hospitals. We never did completely figure out where the blood came from. We asked for blood and it appeared. Compatibility testing was carried out right at the bedside in a bowl with four separate dividers. The two blood samples were mixed and observed for hemolysis. All though we never had any life-threatening transfusion reactions, we did have a few icteric appearing patients. Only one patient was critical post op and the group was grateful for my “Gee, I’ll pack everything” attitude. Although, the patient used almost our entire stock of supplies, she was extubated and doing well at the time of our departure.

Our most vivid memories come from the families of the patients we cared for. After each operation the family almost miraculously prepared an incredible feast which we were required to attend lest we insult our hosts. Family members dressed in 20th century clothing and authentic colorful tribal costumes served a vast array of authentic Mongolian dishes (especially all sorts of lamb and goat) and, of course, vodka. Now, trying to explain why we couldn’t drink alcohol prior to another case when it is common place with every meal was a bit of a cultural dilemma. These people have very little in the way of wealth and we are sure that these lavish dinners are a tremendous financial drain on these families. Their warmth and gratitude are overwhelming and provide the very basis of why we travel such a distance to provide care for a population we don’t fully understand.

At this point we have replaced their anesthesia machine and taught the importance of avoiding hypercarbia and hypoxemia. We have provided a new set of surgical equipment and are presently teaching the importance of maintaining the equipment. On the upcoming 2003 trip a new bypass machine will replace theirs and hope to provide more a more stable platform for cardiopulmonary bypass.
procedure. The nurses were encouraged to attend a series of lectures discussing the post op care of these patients and how to manipulate and obtain the information from arterial lines and swan ganz catheters. This training will continue this year with bedside nursing using poster boards and a greater number of interpreters. The routine loss of oxygen will be finally solved with the placement of a simple manifold system which will alarm when a tank is low on pressure. As for the physicians, a great deal of one to one training has been done and now will be followed with a conference-like format for all physicians in Ulaan Baatar. We have been very fortunate with donations of medical literature and various forms of media oriented information on central line placement and ECHO. The final undertaking is to determine the accuracy of the lab and the ability of medical personnel to make accurate assessments and initiate treatment if indicated.

All in all the work is fulfilling and spiritually enlightening. The privilege to share our knowledge to improve the outcomes of an entire country is not lost on us. We continue to return despite the long travel time, hard work and financial drain on many of the members. Our relationships have evolved to a warm professional relationship with incredible respect on each side for the talents and mutual concern for ill patients.

We are now mostly vegetarians during our trip, especially after the marmot barbecue, and bathing isn’t a daily necessity as long as everyone else follows suit. No one laughs at my waterless bath solution anymore. Why did we decide to go into medicine?—to care for patients, and it’s as simple as that... and a heartfelt hug and thank you is our payment for what we do every day.
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