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Anaesthesia in outreach surgical camps: more of arts than science

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Abstract

People living in mountainous districts of a country like Nepal have little or no access to basic medical and surgical care facilities. The limited care they receive is through outreach camps organized time to time by governmental and several non-governmental organizations. For patient safety reasons organizing surgical outreach camps is logistically very challenging. Providing safe anaesthesia in such setting is even more challenging. The anaesthetic cares provided in such settings have mostly been guided by the experience of the anaesthesiologists in the team. Based on the accumulated evidence and experience of the author, this article intends to give an outline of planning, organizing and executing anaesthetic care in surgical outreach camps in remote difficult terrains of a country like Nepal.

Keywords: anaesthesia; community outreach; remote locations; surgery; surgical camps

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Background

Significant proportions of population in many of hilly countries of the world including Nepal live in geographically difficult and remote terrains. They are practically beyond the regular access of services of health care facilities and are catered through temporary outreach programmes organized time to time.^{1,2} In many of the mountainous districts of Nepal, road access is either in the form of a track just linking the district head quarters or not present at all. Some of the places are linked by air with small air strips with maximum one or two flights of small planes

taking place depending on the weather and season. One can easily imagine the status of health care facilities in such practically inaccessible places. Surgical facilities in such places are practically nonexistent for the local people who cannot afford leaving their places of dwelling.

It is not only the lack of infrastructures and facilities in remote places responsible for the situation but also the health seeking behavior of the people living in such places. Despite suffering from many surgical diseases and

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conditions they do not even feel that they need treatment and their health conditions can be improved. Initial estimate suggested 11 % of global burden of diseases is treatable with surgical interventions³ but experts estimate some 28% of global burden of diseases to be surgical.⁴ Treatable surgical conditions are estimated to be responsible for 1.8 million deaths in low- and middle-income countries. In other words, one death occurs every second in those countries of which 85% are treatable by basic surgical care.⁵ Undoubtedly, the situation is likely to be worse in inaccessible remote places.

It may take several decades for regular surgical care to be easily accessible for the people living in remote and difficult terrains of developing countries.⁶ Therefore organizing outreach surgical camps seem to be the only available and practical option to mitigate the problem. Surgical outreach camps are organized time to time by national and international agencies in many developing countries. In some instances camps organized locally are financially and logistically supported by national and international agencies. The importance of knowhow of organizing outreach surgical camps in difficult terrain has been highlighted by the recent earthquake of Nepal also.

The main concern being raised in organizing such outreach surgical camps is about the safety of the patients. It is a concern not only for the organizers but also for the patients themselves.⁷ Marginally higher postsurgical complication rate has been found in health camp settings compared to regular hospitals in an impact analysis study of uterine prolapsed surgery in Nepal.⁸ In any situation, adverse outcome is always a possibility in medical practice, but it is more likely in such scenarios. The organizers, therefore, must seriously consider about the safety issues at the time of planning and organizing such camps. Providing anaesthetic and perioperative care is in itself a challenging and risky task in any setting; it can be extremely challenging in surgical outreach setting.^{6,9} The members of the team have to work outside their regular comfort zone. Expectedly, expert anesthetic care can bring out better surgical outcomes as the surgeon can focus more on the surgical aspects. There are no clear cut general guidelines on the conduct of anaesthesia in such camps and therefore, often it is the anaesthesiologist's experience that guides the care. Availability of guidelines of anaesthetic management in such camps can be of great value to new anaesthesiologists participating in such camps. Guidelines prepared by international missions for some specific projects such as plastic surgery¹⁰ can be of some help.

Challenges

Besides the task of working in adverse conditions, there are several clinical challenges to be faced by the anaesthesiologist in the team. Patients are likely to present with advanced staged surgical problems that the team members may have encountered rarely in their routine

practices. The number of the patients may be overwhelming requiring rapid case turn over. Even more challenging may be the medical co-morbidities in the patients presenting in such camps. Chronic respiratory diseases, nutritional deficiencies and helminthic manifestations are common in patients in such setting.

Despite such clinical challenges, the setting demands rapid patient screening and operative turnover, brief recovery, optimal postoperative recovery in the hands of minimally experienced supervisors. As a team member, one must have the ability to modify usual requirements according to the situation. Therefore this challenging situation requires accepting higher risks at times than usually done. In other words, one has to be able to provide ideal care in the least ideal setting.

Approaches and settings

There can be varying approaches in organizing and managing surgical outreach camps in remote difficult terrains. It can be in the form of general approach in which different types of surgical procedures may be performed or more commonly specific diseases or clinical condition related procedures e.g. plastic surgical, utero-vaginal prolapse, cleft repair etc may be performed depending on the mission of the outreach camps. It is important to note that great flexibility is required in practice at times. Practically a venue such as already existing district hospital or health center is chosen for the purpose of conducting the camps. Mostly these places may be accessible via off-road tracks using four wheeled drive vehicles. But some places are accessible only through chartered planes or helicopters. For the ease of the conduct of the camps rainy season is avoided (Figure 1). Similarly too cold season is also avoided in high mountainous places in view of difficulty in management and logistics. In very remote terrains, availability of a standby helicopter does not only ensure safety but also increase the confidence of the team members. However, such provision becomes more of a theoretical issue than practical one because of the extortionate cost involved.



Figure 1: Difficult terrain with off-road track in rainy season

Preparation

It is best for the team if one of the team members (preferably a senior member) can visit the venue site during planning phase. He/she can build up rapport by interacting with the local people and clarify expectations. This not only gives opportunity for inspecting the probable venue but also for assessment of available local facilities and supplies. Moreover, the member can work out necessary arrangement of accommodation, food, security for the rest of the team members. Opportunity to inspect the host hospital (probable venue) furnishes important information in planning and organizing of the camp. Assessment of the capacity to accommodate expected volume of patients, families and relatives is possible. Availability of electricity and back up facility such as oxygen, suction, laboratory, x-ray, pharmacy, blood bank, system of communications can be assessed. More importantly, it is possible to assess and estimate anticipated effect on the hospital routines. Surgical camp should not adversely affect the routine functioning of the hospital or health center. More commonly practiced approach, however, is to get information from the local doctor or health administrator about the above discussed issues.

Screening arrangement is one of the important aspects of conducting an outreach camp. This arrangement provides opportunity to identify risky cases and cases that require special attention. For general type of screening much sophistication is not necessary. Noninvasive blood pressure cuff, stethoscope, electrocardiogram (ECG), weighing machine and tongue depressor are essential equipment and must be ensured. Availability of portable spirometer can be of special value in patients with respiratory problems. If available, small multi-utility portable ultrasound machine can contribute immensely to the patient safety.

While inspecting the probable operating rooms, attention should be paid to the number of rooms to be utilized, number of operating tables to be utilized, adequacy of rooms and space for equipment and supply storage, availability and functioning status of operating lights, availability of oxygen cylinders and concentrators, availability of room warming and cooling devices, availability and functioning of suction apparatus and tubing. Likewise it is equally important to identify the recovery area ensuring availability and adequacy of space, beds, monitoring facilities, warming arrangement and patient transport arrangement. Further, supervision arrangement in the recovery area must be ensured.

Modes of transport of supplies depend on the location and accessibility of the outreach camps. In places not connected by roads supplies are transported in small plane or helicopter. A helicopter also might be the only mean of evacuation in case grave emergency requiring transfer of patient to a tertiary care centre. Small four wheel vehicles are appropriate for places connected by roads or tracks.



Figure 2: A chartered aeroplane for transport of medical supplies

Ideally the team should include a senior experienced anaesthesiologist, a resident in anaesthesiology, one trained operating room technician and a biomedical technician. Availability of a biomedical technician allows unhindered equipment uses.

Execution

A common practice is that the entire team arrives one or two days prior to the announced date of starting of the camp. It is important for the team to meet with the local coordinator and discuss issues focusing on the exact scope of surgical procedures to be performed. It is necessary for the team to hold inter/intra disciplinary meetings to share information, problems faced and possible tips. Besides these meetings help release the anxiety and apprehension one may have.

Working in an outreach surgical camp is outside one's comfort zone. Therefore, a team member may encounter number of stressors. Unfamiliarity and different taste of food may be a problem. Due to long and unrestricted working hours, fatigue and sleep deprivation problems are common. Need to wake up during night to manage complication can be frequent. There may be situation of conflicting interest and disagreement between and among the team members. Situation of excessive social commitments are likely to arise. One must be aware about his/her own limitations before making any commitment. Expectation of general public can be beyond the capacity of the team.

Patient screening is one of the most vital steps in making the camp successful. While screening the patients for surgery the goal of the mission must always be kept in mind. Case selection must depend on the availability of the surgical and anaesthetic expertise, the available support staff, and the available supplies and facilities such as operating room capacity, recovery room capacity etc. The patients must be carefully prioritized. Prioritization must be realistic; one should not be carried away with its emotional appeal. Such a camp is not a place of experimentation. One must remain firm in attitude and keep the ability to inform the patients with bold yes or no.

A careful preoperative assessment is vital to ensure safety. Any important information missed during screening may be detected during the preoperative assessment. Anaemia, parasitic infestations and reactive airway diseases which can have implications in anaesthetic and perioperative management are commonly encountered. During preoperative assessment one must be careful that some patients knowingly hide their problems for the fear of not being accepted for surgery. Such patients if identified must be appropriately explained the risks and counselled. While preparing the surgery list, sick and young children should be kept early in the day and early days. It is wiser to keep simple cases on the first day as far as possible. This not only allows the team to settle in the new setting but also gives opportunity to identify and manage unforeseen problems in the setup if any. In order to maintain cordiality with the local organizing members, local requests for accommodating cases should be anticipated. Such requests should not be ignored and possibility should be sorted out and the reality be clarified. After preoperative assessment and preparation of the surgery list, the patients must be clearly informed as to where, when and how to report. Nil per oral instruction must be clearly conveyed and the risk explained if the instruction is violated. Consent must be taken carefully. Often there can be unrealistic expectations of the family warranting adequate explanation and discussion.

The minimum standard of care even in such outreach surgical setting must not be compromised. Using checklists helps in ensuring essential items and not missing minutest ones. Small portable anaesthesia machine with halothane vaporizer with circle and semi-open system (Bain's system and Ayre's T piece) are most commonly employed with better portability. Resuscitation kits with complete gadgets and drugs need to be kept in appropriate place accessible to all perioperative area including post anaesthesia care unit. Provision of supply must be made in excess of expected consumption as a margin of safety. The resuscitation kit must contain a portable defibrillator, self-inflating resuscitation bag, various sized LMAs, oral and nasal airways, IV cannulas of all sizes and all emergency resuscitation drugs.



Figure 3: Essential items in the operating room of an outreach camp

(Note the oxygen to drive anaesthetic gas from the portable vaporizer is being used from a concentrator and the cylinder is kept as backup. Other anaesthetic equipments and drugs and monitor are in the background)

Monitoring of the patients in outreach surgical camps must comply with the minimum intra-operative patient monitoring standards. Monitoring of adequacy of ventilation, oxygenation and circulation is compulsory. Continuous pulse oximetry, ECG, pulse, NIBP, temperature and capnography fulfill adequate monitoring requirement for almost all types of surgeries carried out in outreach surgical camps. Use of WHO surgical check list can minimize many potential adverse events.¹¹

Management of equipment, devices and items may be different from the routine practice in the regular centers. Because of logistic limitations even disposable items may be used after proper cleaning and sterilization. Sterilization norms must be followed without any deviation; any compromise can lead to devastating consequences. Portable autoclave machine (electrical or firewood heated), boilers and chemical sterilizer such as glutaraldehyde are the most practical options in the setting. Safe practice is obviously more important than being aesthetic.

Anaesthetic techniques

Since the time available for evaluation and observation is less, premedication must be very judiciously used. Antisialagogues are commonly used if the surgery involves structures around the mouth and airway. Unless specifically undesirable, benzodiazepines can be used safely. Ketamine can be used as a good premedicant particularly for separating children from their parents, but needs adequate supervision and observation.

Wherever appropriate and possible, regional anaesthetic techniques should be used as a sole technique or to supplement general anaesthesia. Subarachnoid block and caudal blocks are commonly used for procedures involving lower abdomen, pelvis, perineum and lower extremities both due to short performance time and predictable effects. Upper limb surgeries can be accomplished using single shot brachial plexus block. Despite some risks of pneumothorax (rarely clinically significant), supraclavicular perivascular approach using landmark technique is frequently used; rapid and reliable block in experienced hands make it the approach of choice. A portable ultrasound machine, if available, can increase its safety tremendously. Bigger children who can be counselled also tolerate the pain of supraclavicular brachial plexus block reasonably well.

If regional anaesthesia is used as a sole technique, there is a need of sedation which can be easily accomplished by administering midazolam or small dose of ketamine intravenously. Additional advantages of regional techniques not only include quiet emergence but also provision of quality analgesia in the immediate postoperative period. If used with adrenaline locally, blood loss is also minimized. Some anaesthetists even repeat subarachnoid block but it must be considered carefully after ensuring complete lack of the initial block as the backup provision for resuscitation in the event of complication is limited.

General anaesthesia provides the best surgical conditions and, therefore, facilitates completion of surgery in difficult and unaccustomed set up. Maintaining spontaneous breathing is desirable as far as possible as it may help in earlier patient transfer to post anaesthesia care unit. Both intravenous and inhalational induction techniques are commonly used. If use of muscle relaxant is decided, short acting ones should be chosen. The type of the circuit used may depend more on the availability than appropriateness. Undoubtedly, circle absorber offers the advantage of economy if inhalational agents are used with muscle relaxants; oxygen transport may be one of the major limiting factors (Figure 3).



Figure 4: A possible way of transporting oxygen cylinders to high hills

High altitude and excessive cold ambient atmosphere may be factors requiring special consideration.¹² In high altitude, the partial pressure of oxygen decreases. Therefore, low SPO_2 and hypoxemia are likely warranting use of higher FIO_2 . In altitudes above 2000 m boiling points of inhalational agents drop necessitating care and understanding. Essentially there is no place of nitrous oxide in such situation. Regional technique or total intravenous anaesthesia may be appropriate for oxygen economy.

Excessively hot environment also poses challenges to the managing anaesthesiologist. Potentially hazardous concentration of inhalational agent can occur in environment with temperature higher than normal range. Boiling point of an inhalational agent becomes lower with higher ambient temperature. In this context, owing to the higher boiling point sevoflurane may be more appropriate but cost may be the major limiting factor. Theoretically monitoring of end tidal anesthetic concentration can minimize the risks. Consistent climate controlled environment is essential for safety. In these situations also, regional techniques and total intravenous anaesthesia may prove more appropriate.

Low ambient temperature also warrants special attention. It increases risks of both intraoperative and postoperative hypothermia. Arrangement of warming facility is essential. Controlled environment is essential for ensuring safety here also.

Morphine and pethidine are the most frequently used opioid analgesics intraoperatively and postoperatively. Generally low or lower normal doses are used. Tramadol is also frequently used postoperatively. Diclofenac and ketorolac are the commonly used non-steroidal anti-inflammatory drugs (NSAIDs) perioperatively as they can be administered parenterally. They offer advantage of opioid sparing effect thereby enhancing recovery and causing less sedation. Infiltration of local anesthetics at the incision sites and regional nerve blocks provide excellent analgesia offering smooth transition to postoperative period and obviating excessive sedation. Neuraxial opioids may provide excellent analgesia but must be used cautiously as unpredictable levels of respiratory depression can occur.

Post-anaesthetic care

Due to the need of rapid turnover of patients in outreach surgical setting, adequate post-anaesthetic care unit (PACU) beds must be arranged. The number of PACU beds must be at least equal to the number of operating tables. Availability of PACU bed can be a major rate limiting factor when surgical procedures under general anaesthetic have rapid turnover as recovery time may be longer than the operating time. Provision of oxygen source (cylinder or a concentrator) is important but often difficult to arrange. There must be at least one pulse oximeter between two PACU beds. Adequate number of equipment for vital signs monitoring must be available. Use of regional techniques/ nerve blocks can avert many of the potential complications in the PACU. Full consciousness, comfortable breathing, adequate oxygenation on room air and good pain control are essential prerequisites for discharging patients from PACU; patient monitoring in the general wards are mostly not up to the mark in such outreach setting.

Special precautions

Team members need to remain alert all times as sudden calls from the wards are not uncommon. No cases should be operated on the last two days of the trip. The tendency of considering the outreach surgical trip as a weeklong picnic or vacation can prove dangerous. Unexpected situations might erupt any time. Life threatening complications or even death can also occur during and after operation. A tactful, careful, realistic and firm approach is essential in such situation; getting panicky and losing composure can further worsen the situation and add stress. The approach may include temporarily halting the surgery, discussing with the local people and family members, preparing an incident report and holding conference and debriefing among the team members.

To volunteer in a surgical outreach camp is not only to work outside one's own comfort zone but also to be ready to face adverse ambient environment with no or erratic electrical supply and other regular commodities such as water and food. Unavailability of blood and blood products is another important challenge. This problem can be addressed if the local Red Cross Society has blood

banks in the vicinity of the outreach camp. There may be list of individuals with identified blood groups who can volunteer to donate blood when required. This system, also known as mobile blood banking, exists in some of the districts of Nepal. Successful autotransfusion following normovolemic hemodilution has also been reported in such a camp setting.¹³

Rewards

The outcome of surgical treatment is immediate and obvious and can make drastic difference in patient's condition which is unlike treating any chronic medical conditions such as diabetes and hypertension. There are unimaginably gratifying rewards; hysterectomy done in middle-aged lady cures her anaemia due to fibroid uterus for ever; cleft palate and lip repair allows a child to speak clearly and tangibly and probably to join school; contracture release or club foot repair in a child allows him/her to use the affected part. Obviously, these are only few examples among many. Besides, participating in such trip provides opportunity to know about new people and places. It allows one to test one's own clinical competence and thereby strengthens clinical decision making skills.

Future

It seems very unlikely that regular surgical care will be available to the majority of people living in remote difficult terrain of a developing landlocked country like Nepal in near future. Therefore, outreach surgical trips will continue to be organized to help reduce the burden of surgical diseases and conditions. We may change some of our approaches and modify them to enhance safety. More use of ultrasound guidance in anaesthesia will make many of the procedures safer and more effective. The concept of telemedicine has already entered in many aspects of health care in the developing countries. It can be effectively utilized in screening, preanaesthetic evaluation and postoperative follow up of patient of outreach surgical trips.

Conclusion

Surgical outreach camps still remain only options for many people living in difficult terrains of remote location in a landlocked country like Nepal. Careful preliminary planning, preparation and site visit in collaboration with the local hospital (probable venue) and local community can minimize undesirable events in such camps. Motivated anaesthesia team members, careful patient selection, provision of adequate staffing and essential supplies and continuous efforts at finding out system issues can increase patient safety and thereby overall credibility of the efforts. One can get unimaginably gratifying rewards (in the form of self-satisfaction) from such outreach camps. It is indeed worth experiencing at least once.

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