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Anaesthetic considerations for head and neck cancers in patients undergoing reconstructive free flap surgeries- a review of 55 patients

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Abstract:

A retrospective study was conducted at Dr Bhubaneswar Borooah Cancer Institute, Guwahati Assam in 55 patients who had undergone free flap reconstructive surgery following resection of head and neck cancers over a period of 2 years from 2018 to 2020. General anaesthesia with either endotracheal intubation or cuffed tracheostomy tube was used. Anterolateral thigh, radial forearm and free fibular flaps were used for reconstruction. The mean anaesthesia time was 29.8 hours which included the time from induction to extubation. Out of which the surgery mean time was 10.6 hours. Of the 55 free flap surgeries, there were 4 failures, two of which were intraoperative leading to the surgeon abandoning the procedure. Optimal utilization of advanced anaesthesia techniques as well as improvement in surgical expertise can further increase the use as well as reduce the complications associated with free flap surgeries.

Keywords: Retrospective, reconstructive surgery, free flap, anaesthesia

Introduction:

Terms like free flap, island flap, free autologous tissue transfer and microvascular free tissue transfer are similar which are used to describe the transplantation of tissue from one site of the body to another, to repair the existing defect. The 'free' word denotes that the tissue is completely removed from the original site (donor) to another site (recipient) where the circulation is gained by arterial and venous anastomosis. Various types of tissue may be transplanted as free flap including skin and subcutaneous tissue, muscle, nerve, bone, cartilage (or combination of any), lymph nodes and intestinal segments. Free tissue transplantation by microvascular anastomosis was performed by Goldwyn[1] and Krizek[2] in animal models in the 1960s. The first successful reported free flap in a clinical case was done by Daniel and Taylor[3] in 1973 which marked the discovery of an iliofemoral island flap and its subsequent distant transfer in man.

Head and neck reconstructive surgery has been greatly advancing over the past few years, with fashion of using free or pedicle flap for reconstruction of defects. The pectoralis major myocutaneous flap supplied by the pectoral branch of thoracoacromial artery introduced by Ariyan[4] in 1979 is also used in many centers for head and neck reconstructive surgeries. Reliability of this flap for some defects was doubtful which resulted in the popularity of use of free flaps for large head and neck defects. In turn free flaps require more of microvascular surgery expertise and longer operating time. However at modern times with two surgical teams one operating at donor and the other working at recipient site can shorten the duration of the operation. On the other hand increase in operation time meaning increase in anaesthesia exposure time of the patient. In this retrospective study over 2 years with data of 55 patients we investigated the association of anaesthesia exposure and free flap surgery outcome.

Patient's data:

There were 55 patients out of whom 41 were males and 14 females. American Society of Anesthesiologists (ASA) classification was between 1-2. The mean age was 44.13 years. The youngest one was 14 years old while 69 years was the oldest. The average weight was 52.6 kg, ranging from 28-84 kg.

Diagnosis

Squamous cell carcinoma of oral, nasal and pharyngeal 40

Chondrosarcoma mandible 2

Basal cell carcinoma orbit 3

Osteosarcoma maxilla and mandible 2

Adenoid cystic carcinoma of maxilla and nose 3

Spindle cell sarcoma forehead 1

Rhabdomyosarcoma cheek 1

Veruccous carcinoma buccal mucosa 1

Microstomia with recurrence of squamous cell carcinoma 1

Ewing sarcoma maxilla 1

Flaps used

Anterolateral thigh 24

Radial forearm 18

Free fibula 13

Procedure performed

Commando procedure 32

Excision of orbit and maxilla 3

Hemiglossectomy 5

Mandibulectomy 6

Excision of floor of mouth 4

Others 5

Anaesthetic technique:

In almost all the cases involved, the anaesthetic technique used were basically the same. Preoperative assessment of the patients included the thorough history of the patient of any previous or present major ailment and history of chemotherapy encounter as many chemotherapeutic agents can alter the normal physiology. Physical examination included the general build up of the patient with mainly focusing on the airway assessment as difficult airway is a common scene. Along with it the peripheral veins of the patients were also examined, as many patients who received multiple venesection for blood investigations and those who received chemotherapy have poor veins making peripheral cannulation difficult for anaesthesia introduction.

Preoperatively routine blood investigations were done which included complete blood count, coagulation profile, liver function test, thyroid profile, kidney function test, chest x ray, electrocardiogram, viral markers and blood glucose level. After the patient's arrival in the operation theatre routine monitors were attached which included 5 lead electrocardiogram, pulse oximetry and blood pressure. A wide bore peripheral cannula was inserted.Subclavian vein catheterization was done to observe central venous pressure as well as for fluid and blood therapy. The patients were premedicated with midazolam, glycopyrolate, tramadol and palanosetron (according to body weight). Anaesthesia was induced with propofol(2 mg/kg) and the patient was intubated nasally with appropriate size cuffed flexometallic tube using non depolarizing muscle relaxant. When difficulty of airway is anticipated laryngoscopic attempts were done using depolarizing muscle relaxant with a fibreoptic bronchoscope. Awake tracheostomy under local anaesthesia was done as a last ditch way to secure the airway in case of failure of fibreoptic intubation. Central venous catheterization, arterial blood pressure monitoring and Foley's catherization were done in all patients. Anaesthesia was maintained with oxygen:nitrous oxide =50:50 and isoflurane. Analgesia was given by paracetamol and diclofenac. Monitoring of electrocardiogram, pulse oximetry, arterial blood pressure, central venous pressure, central and peripheral temperature, end tidal carbon dioxide were done. Fluid mainly consisted of hartmann's solution according to 4:2:1 rule.

There was no requirement of vasodilators or vasopressors in any of the patients. After the completion of surgery the patients were knocked out using vecuronium bromide and tramadol infusion as suggested by surgeons for the rest to the free flap for atleast 12 hours after which the patients were reversed and endotracheal tube removed. Patients with tracheostomy were reversed and given oxygen inhalation with T-piece.

Results:

The mean anaesthesia time was 29.8 hours which included the time from induction to extubation. Out of which the surgery mean time was 10.6 hours. Of the 55 free flap surgeries, there were 4 failures, two of which were intraoperative leading to the surgeon abandoning the procedure .Local flap repair was done in both the cases. One of the 4, failed on the first post-operative day, re-exploration done and the other failed on the 7th day of post operative. Two (2) patients where free flap failed were already tracheostomised and the other two were tracheostomised using local anaesthesia before re-exploration. Tracheostomy as a whole was done in 12 out of 55 patients.

The mean blood loss of all patients was about 1000 ml with a maximum of 1625ml and minimum of 865 ml. Mean packed cell volume replacement was about 2.4 units ranging from 1 to 4 units intra-operatively. Fluid replacement was done mainly in the form of crystalloids with a mean volume of 2800 ml. Mean urine output was about 110ml/hour. Mean preoperative haematocrit of all patients was 40% ranging from 32-50% and postoperative mean haematocrit was 34% ranging from 28-40%. Two (2) patients had been tracheostomised under local anaesthesia as anticipated difficult airway.

Discussion:

Head and neck cancer comprises of cancers originating from mouth, sinuses, nose and throat. It can also begin in the salivary glands but are uncommon. This kind of cancer originates from the squamous cells which are the lining of the surface of the structures in head and neck and those from salivary glands are usually classified as adenocarcinoma, adenoid cystic carcinoma or mucoepidermoid carcinoma. Tobacco and alcohol contributes the most for the head and neck cancers. Viruses like human papilloma virus, Epstein barr virus, sunlight exposure, poor oral hygiene, betel quid chewing, radiation exposure and wood dust (occupational) are other contributors to head and neck cancers. [5]

Oral cavity and oropharyngeal cancer impose significant threat to airway management. The concurrent use of radiotherapy may further increase the difficulty of tracheal intubation as well as mask ventilation. The anaesthesiologist may have to encounter difficulties like reduced mouth opening, reduced neck mobility, big tumor mass or anatomical disruption due to previous surgery which requires expertise in dealing with anticipated difficult airways.[6] In our study, we got 8 cases of anticipated difficult airway out of which 2 patients were tracheostomised under local anaesthesia. The rest of the anticipated cases were managed with fibreoptic intubation.[7]

Another difficulty with cancer patients is of obtaining peripheral venous access which may be because of elderly age group or due to chemotherapeutic agents. In our study we got difficulty in 1 patient to obtain peripheral venous access for which central venous catheterization was done directly. In free flap surgeries the location of donor graft has to be taken care of which excludes the use of one or more limbs for peripheral lines.[8]

Free flap reconstructions need normothermia to maintain an optimal blood flow for the vascularized free flap by: increasing circulatory blood flow as well as maintaining a normal temperature for prevention of peripheral vasoconstriction. Hypothermia also produces a rise in hematocrit and plasma viscosity, with erythrocytes and platelet s aggregation .The operation theater was therefore kept at optimum temperature (24-25℃) to prevent heat loss. The difference between the central and peripheral temperatures should not be higher than 2℃.A high gradient may reflect low volume status of the patient or decrease in the cardiac output. Warming blankets were used to maintain optimal body temperature.Morever,the fluids administered were preheated to 36.5℃ using a fluid warmer. In our study we have administered crystalloid fluid in the form of hartmann's solution using the formula 4:2:1 and oxygen concentration of 50% to prevent hypoxia.[9] A minimum hematocrit of 30% was maintained at all times as low hematocrit concentrations can lead to prolonged bleeding times. Consistent hypotension after the graft could lead to hypoperfusion of the graft resulting in rejection of the graft. End tidal carbon dioxide was monitored throughout the operation time to maintain normocarbia of the patient. Vasoconstrictors were not required in any of the patients. Peripheral vasoconstriction was prevented intraoperatively by maintaining the heat loss, filling the blood vessels with adequate fluid and by the use of inhalational anaesthetic agents.[10]

Intraoperative deep vein thrombosis prophylaxis was maintained by using inflatable anti DVT leggings and postoperatively low molecular weight heparin (Enoxaparin sodium) at a dose of 40mg once daily was used for consecutive 5 days. No complications of deep vein thrombosis were seen in our study.

All the patients in our study were knocked out using vecuronium infusion and fentanyl infusions for at least 12 hours post operatively. Post-operative analgesia was maintained using intravenous paracetamol infusion as well as buprenorphine dermal patch (5 mcg). Opioids minimize hemodynamic responses to intubation and surgical stimuli intraoperatively as well as provide analgesia during the early postoperative period. Fentanyl is a suitable analgesic in microvascular surgery, providing hemodynamic stability and, possibly, protecting the myocardium against ischemic injury.[11]Postoperatively, early ambulation and start of feeding was the main focus as soon as bowel sounds were heard.

Fifty five (51) cases out of 55 cases were successful indicating a good success rate (92.7%). A similar success rate was also observed by Inglis et al[12]. The failed 4 cases included three women and one male.

All were young adults. The reason could have been technical errors from the surgical point of view as well as the infantile stage of free flap surgery in our institute. With the proper optimization and utilization of anaesthesia (better drugs, monitoring, equipments and techniques) and increase in surgical expertise, further reduction in complications in reconstructive free flap surgeries of head and neck cancers can be expected.

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