Case Series

Multimodal blood loss prevention bundle for endoscopic resection of juvenile nasopharyngeal angiofibroma: A case series

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ABSTRACT

Surgery for excision of juvenile nasopharyngeal angiofibroma (JNA) carries the possibility of massive life-threatening haemorrhage. Anaesthetic management aims to maintain haemodynamic stability and reduce blood loss. This case series describes the application of the bundled approach as a multimodal blood loss prevention bundle (MBLPB). Twenty patients underwent 23 surgeries with MBLPB. The blood loss and the number of units of blood transfused were recorded. The surgeon satisfaction score was assessed. The median [interquartile range (IQR)] estimated blood loss was 1300 (650–2350) ml. Patients with tumours in stages I and II had a median (IQR) blood loss of 550 (270–750) ml compared to patients with higher grades of tumours (stages III, IV) with a median (IQR) blood loss of 2100 (1300–2500) ml. Median (IQR) units of packed red cells transfused was 1 (0–3). The surgeon's satisfaction score was high when MBLPB was applied for JNA. However, it does not appear to reduce blood loss markedly.

Keywords: Anaesthesia, blood transfusion, dexmedetomidine, juvenile nasopharyngeal angiofibroma, reverse Trendelenburg position, tranexamic acid

INTRODUCTION

Juvenile nasopharyngeal angiofibroma (JNA) is a highly vascular tumour. Surgery is the gold standard for treatment. However, serious and life-threatening bleeding is a potential complication of surgery.[1] Various techniques like a reverse Trendelenburg position, use of tranexamic acid, control of heart rate (HR) and blood pressure by α-agonists and β-blockers, propofol infusion[2] and preoperative embolisation have been described to control bleeding during endoscopic nasal surgery.[3] Few studies have described the anaesthesia management of JNA.[4-8] However, a bundle approach has not been studied. This series describes the application of a multimodal blood loss prevention bundle (MBLPB) approach [Table 1] and its effect on blood loss and transfusion requirements in patients undergoing endoscopic resection of JNA.

METHODS

MBLPB was applied after obtaining approval from the institutional ethics committee (vide approval number HR, IEC-/33/16, dated 11/04/2016) of a tertiary care hospital. All patients aged 10–35 years, belonging to the American Society of Anesthesiologists, physical status I/II and undergoing endoscopic resection of JNA from August 2016 to September 2017 were administered MBLPB. Patients suffering from known bleeding disorders or having known allergies to any of the study drugs and non-consenting patients were excluded. The baseline HR, mean arterial pressure (MAP) and haematological findings were noted.

In the operating room, after securing intravenous (IV) access, patients were administered IV midazolam

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Table 1: Components of the multimodal blood loss prevention bundle
Dexmedetomidine IV infusion at a loading dose of 1 μg/kg in 10 min, followed by a maintenance dose of 0.5 μg/kg/h
Minimum alveolar concentration between 0.8 and 1
Target heart rate between 50 and 60 beats per minute
Target mean arterial pressure between 55 and 65 mmHg
Target end-tidal carbon dioxide at 30 (±2) mmHg
Tranexamic acid IV at 10 mg/kg over 15 min, followed by 1 mg/kg/h infusion
25° reverse Trendelenburg position

IV=Intravenous

0.02 mg/kg and fentanyl 2 μg/kg. Anaesthesia was induced using IV propofol 1–2 mg/kg and vecuronium 0.1 mg/kg. The arterial and peripherally inserted central lines were secured. Routine HR, blood pressure, central venous pressure, end-tidal carbon dioxide ($EtCO_2$), temperature and urine output were monitored. Dexmedetomidine IV infusion was started at a loading dose of 1 μg/kg in 10 min, followed by a maintenance dose of 0.5 μg/kg/h. Anaesthesia was maintained on oxygen, nitrogen oxide, desflurane and vecuronium. The minimum alveolar concentration was maintained between 0.8 and 1. The target HR was kept between 50 and 60 beats per minute. MAP was maintained between 55 and 65 mmHg. Propofol 25–50μg/kg/min was added if the target HR or blood pressure was not achieved. If the target HR was not achieved, IV metoprolol was given in titrated doses. IV fentanyl in aliquots of 1 μg/kg was repeated as per the clinical judgement of the consultant anaesthetist. The total amounts of IV propofol, dexmedetomidine, fentanyl and other drugs used were noted. Ventilation was adjusted to keep $EtCO_2$ at 30 (±2) mmHg. IV tranexamic acid 10 mg/kg was given over 15 min, followed by a 1 mg/kg/h infusion. A 25° reverse Trendelenburg position was given. Blood loss was measured and recorded by closely monitoring the suction bottles. Baseline haemoglobin (Hb), haematocrit (Hct), complete blood count and prothrombin time (PT)/international normalised ratio (INR) were noted and monitored intraoperatively at the discretion of the consultant anaesthetist. Blood was administered when Hb was <8 g/dl or Hct was <25%. Fresh frozen plasma was transfused if INR was >1.5, and platelets were transfused if the platelet count was <50,000/dl and between 50,000 and 1,00,000, depending on the surgical bleeding. Hb, Hct, complete blood count and PT/INR were repeated at the end of the surgery and after 24 h. The number of units of blood products transfused was noted. Surgeon satisfaction was assessed by a numerical rating scale from 1 to 10, where 1 represented the worst possible operative field and 10 represented the best possible field at the end of the surgery.

Normally distributed data (HR, MAP, duration of surgery and dose of dexmedetomidine) is represented as mean [standard deviation (SD)], and non-normally distributed data (age, blood loss, number of packed red cells transfused and doses of fentanyl and propofol) is represented as median (interquartile range [IQR]). Blood loss was compared using the Mann–Whitney U test. A P value <0.05 was considered significant. Data was analysed using Microsoft Excel 2021 and online calculator https://www.socscistatistics.com/.

RESULTS

Twenty patients underwent 23 surgeries with MBLPB. Patients' median (IQR) age was 17 (15–21.5) years. Fifteen patients were in Andrew's classification stage III/IV. Nine patients had undergone preoperative embolisation. The median (range) (IQR) estimated blood loss was 1300 (150–5000) (650–2350) ml. Eight patients with tumours in stages I and II had a median (IQR) blood loss of 550 (270–750) ml, compared to 15 patients with higher grades of tumours (stages III, IV) with a median (IQR) blood loss of 2100 (1300–2500) ml (P = 0.001). The median (IQR) blood loss in nine preoperative embolisation patients was 1700 (700–2500) ml. The median (IQR) blood loss in the 15 patients who did not undergo preoperative embolisation was 1200 (625–2075) ml (P = 0.66). The patients received a median (range) (IQR) of 1 unit of packed red cells (0–8) (0–3). The mean (SD) HR was 64 (5) per minute, and MAP was 64 (3) mmHg. The mean (SD) duration of surgery was 6.5 (1.8) h. The mean (SD) total dose of dexmedetomidine used was 164 (91) μg. The median (IQR) total dose of fentanyl used was 130 μg (100–200). The median total dose of propofol used was 155 (72.5–325) mg. The haematological parameters of patients are presented in Table 2. The median (IQR) surgeon satisfaction score was 9 (8–10). Glycopyrrolate was administered to three patients because of bradycardia, one of whom also had to be administered 12 mg of ephedrine for hypotension. In one patient, atropine was administered for bradycardia and dexmedetomidine had to be stopped. Metoprolol was administered to one patient to achieve the target HR. Surgery was stopped and completed at a later date in three patients because of significant blood loss. All patients were haemodynamically stable. Two patients required ventilatory support for 1 day because of a haemorrhage.

Table 2: Haematological parameters at various time points

Parameter	Baseline	Intraoperative	Immediate post-op	24-h post-op
Haemoglobin (g/dl)	12.9	10.6	10.5	11.6
Haematocrit (%)	36.46	25.73	27.51	29.92
Platelet count (cells/mm^3)	2.56	1.99	1.81	1.7
International normalised ratio	1.10	1.43	1.20	1.16

post-op: Postoperative

DISCUSSION

The blood loss in our series was similar to that in previous reports.[6,8] The number of units of blood transfused in our series was lesser than that in other studies,[7,8] which reported a higher rate of haemorrhage and a lower rate of preoperative embolisation. Embolisation reduces bleeding to a large extent due to the increased vascularity of the tumour.[3] However, bleeding encountered during functional endoscopic sinus surgery (FESS) is also from the richly vascularised capillary beds of the sinonasal mucosa. Larger vessels are not usually the cause of bloody fields in FESS. Bleeding from nasal mucosa is a function of HR, MAP and central venous pressure. Systemic vascular resistance can be reduced using vasodilatory agents like inhalational agents, for example, desflurane. The cardiac output can be decreased by choosing drugs that reduce the preload and contractility, for example, β-blockers, or drugs that reduce HR, for example, α-agonists.[2] Various techniques have been described for reducing blood loss and providing a quiet surgical field.[2] Hypocapnia has been adopted to minimise the bloody appearance of the surgical field during septorhinoplasty.[9] Tranexamic acid has been shown to lower blood loss during JNA excision.[2] The reverse Trendelenburg position also helps improve the venous return and the surgical field.[2] A recent report of three cases describes using a comprehensive approach, including acute normovolaemic haemodilution, in patients undergoing endoscopic JNA resection.[4] Care bundles have been known to improve outcomes in intensive care.[10,11]

CONCLUSION

MBLPB for JNA seems useful for providing an excellent surgical field and improving surgeons' satisfaction. However, it does not seem to reduce blood loss markedly in these highly vascular cases, as three cases had to be staged due to massive blood loss, and blood loss was similar to that reported in previous studies.

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Conflicts of interest
There are no conflicts of interest.

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