Does conventional practice prevent ocular complications in prone position spinal surgery?

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Postoperative visual loss following spinal surgery in the prone position may be the most limiting to the quality of a patient's life and the most likely to entail medico-legal consequences for medical and theatre personnel. We analyse the incidence of ocular complications after 181 consecutive spinal surgery in the prone position in a typical district general hospital setting in the United Kingdom. No patient undergoing spinal surgery in the prone position lasting over 2 hours developed postoperative transient or permanent visual loss or any other ocular complication (incidence 0%). Perioperative preventative measures were found to be sufficient to prevent any form of ocular complications. We should inform and reassure patients of the reduced risk of ocular complications in spinal surgery when sufficient perioperative precautionary measures are taken.

Introduction

Postoperative blindness, though a rare complication of non-ocular surgery, may be the most limiting to the quality of a patient's life and the most likely to entail medico-legal consequences for medical and theatre personnel. A number of recent case studies and reviews have given rise to the assumption that perioperative variables, such as intraoperative blood-loss, anaemia and hypotension, play a key role in the reduction of the risk of postoperative vision loss (Ho et al 2005). Perioperative measures such as careful monitoring of blood pressure, eye protection and generous use of blood transfusion may therefore play a vital role in the prevention of this rare but serious complication.

Literature review

In spinal surgery, the prone position in particular has been discussed in association with mono- or biocular blindness. This position is used in a variety of spinal surgical procedures such as spinal fusion or kyphoplasty. It entails the installation of the patient face down on the operating table, with protective support under his chest, knees and head, bringing the spine into a kyphotic curve. Aside from mechanical ocular compression, the three most frequent causes thought to be responsible for visual loss after prone position surgery are

- Ischaemic optic neuropathy
- Retinal artery occlusion
- Cerebral ischaemia (Myers et al 1997)

The underlying pathophysiological mechanisms discussed in connection with postoperative blindness are extrinsic ocular pressure, hypotensive ischemia and increased intraocular pressure (Kamming & Clarke 2005). Therefore, this type of surgery may particularly benefit from careful perioperative patient care during anaesthesia in the supine position, and transferring onto the operating table in prone position to prevent mechanical ocular compression.

The existing literature has attempted to draw attention to cases of visual impairment as direct consequences of prone positioning in spinal surgery. Excellent attempts have also been carried out to determine the incidence of eye complications in spinal surgery. Chang and Miller (2005) have found an incidence of 0.028% of perioperative ischaemic optic neuropathy after spinal surgery. Warner et al (2001) have reported an incidence of 0.0008% of prolonged vision loss in a group of patients who were diagnosed with vision loss after a surgical procedure, however none among the patient group undergoing spinal surgery. Yet the role of perioperative procedures in the prevention of visual loss after prone position surgery has hitherto been discussed only peripherally. Kasodekar and Chen (2006) have presented a case of monocular blindness after prone position surgery and suggested a number of general perioperative guidelines as a result. The American Society of Anesthesiologists Task Force on Perioperative Blindness (2006) has developed a practice advisory for anaesthesiologists. It stated that the risk for and incidence of visual loss in relation to prone position in spinal surgery may be due to the following causes:

- Perioperative blood loss
- Anaemia
- Blood pressure
- Duration of surgery
- Surgical positioning
- Intravascular volume
- Use of vasopressors
- Preoperative and postoperative management.

However, there are only very limited guidelines on the perioperative practice in prone position spinal surgery. In our conventional practice we use prone position with the patient face down on the operating table, with protective support under chest, knees and head, bringing the spine into a kyphotic position. Our aim was to analyse the incidence of ocular complications after spinal surgery in prone position in a typical district general hospital setting in the United Kingdom. The secondary objective of this
CLINICAL FEATURE

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study was to examine whether conventional practice in the theatre environment, provided by the anaesthetist, the allied theatre personnel and the surgeon, can prevent postoperative ocular morbidity.

Method
181 consecutive spinal surgeries performed at University Hospital Lewisham were prospectively studied after obtaining approval from our institutional clinical audit department. It was a longitudinal, single-centre, cohort study. 72 patients (aged 19-90 years, mean age 52) undergoing spinal surgery in the prone position lasting more than 2 hours were analysed, satisfying our inclusion criteria (Tables 1 & 2). The patients were admitted as elective patients under a single surgeon (senior author) between January 2003 and December 2007. All procedures were performed in hypotensive anaesthesia. The length of surgical procedures in prone position varied between 2 and 8 hours. All operations were carried out by two of the authors (MB and SS). None were admitted and discharged on the same day. All patients received the maximum of pre- and intraoperative preventive measures recommended by the existing literature. A careful preoperative screening process for ocular pathologies and other aggravating illnesses such as diabetes and arteriosclerosis was performed in the course of a pre-admission clinic. All revealed ocular and non-ocular pathologies were referred to the patient’s GP or a specialist for assessment and treatment.

Figure 1 Eye protection shield

Intraoperatively, following the induction of general anaesthesia, each patient received application of non-compressible eye protection masks (see Figure 1) in supine position by the anaesthetic theatre assistant. After transfer of the anaesthetised patient to the operating table, every patient was placed on the headrest (see Figure 2) by the attending surgeons and the theatre assistant in prone position. Thorough surveillance of intraoperative blood pressure (mean arterial blood pressure was aimed at 70 mmHg) and generous employment of blood transfusion (minimum transfusion of 1 litre per operation) were practiced during the process of the operation. In the immediate postoperative period (after 24 hours) all patients were reviewed by the operating surgeons (MB and SS) and any complications, including ocular complications, were carefully recorded and appropriately referred to the appropriate specialty. All these patients were reviewed again as outpatients after 6 weeks, 3 months and 12 months from the date of the initial operation.

Results
10 cases out of 181 were performed using an anterior approach and therefore did not qualify for our inclusion criteria. A further 83 patients underwent comparatively minor spinal surgical procedures in the prone position such as microdiscectomy or discectomy (n=34), spinal decompression (n=33) or a combination of both (n=16). These cases were excluded as the time of operation was less than 2 hours and the actual blood loss was minimal. None had reported any ocular complication. 16 patients underwent kyphoplasty in the prone position. Although kyphoplasty is over 2 hours it does not entail significant blood loss, so these cases were also excluded. The remaining 72 patients underwent posterior instrumented spinal fusion in the prone position, with or without decompression, bone grafting or a combination of both, which lasted over two hours and led to a considerable volume of...
Does conventional practice prevent ocular complications in prone position spinal surgery?

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estimated blood loss of over one litre. Mean postoperative recovery time was 7.1 days.

None of the remaining 72 cases undergoing spinal surgery in the prone position lasting over 2 hours developed postoperative transient or permanent visual loss or any other ocular complication (incidence 0%). However, there were a few (n=5) patients who reported peri-orbital bruising, mainly in the lower lid, which had resolved before the patients were discharged. No alteration of their vision was noted at their follow-up appointments. Five patients experienced postoperative hypotension, 3 patients experienced a significant drop in haemoglobin levels and 4 patients displayed postoperative hypoxia. Three patients went into acute renal failure in the immediate postoperative period. None of these patients experienced any visual impairment.

Discussion

Our most significant finding was that preventative perioperative measures adopted in our practice lead to no ocular complications due to spinal surgery in the prone position. We studied a group of patients undergoing spinal surgery with maximum preventative measures in the perioperative process as outlined by the the American Society of Anesthesiologists Task Force on Perioperative Blindness (2006)(Table 3). Patients were screened prior to admission for ocular and other comorbidity such as diabetes, hypo- and hypertension, arteriosclerosis, anaemia and blood clotting abnormalities. Every patient undergoing spinal surgery in the prone position was equipped with protective eye goggles and placed in a 15 degree reverse inclination. Patients' heads were positioned in a protective headrest while making sure that no external compression was applied to the eyes. Intra-operative blood pressure was carefully monitored and never fell below a mean arterial pressure of 70 mmHg. All our procedures were performed using cell saver blood salvage. We also transfused each patient with a minimum of 1 litre blood.

The most obvious shortcoming of our study was the comparatively small number of patients studied. No conclusion can be drawn as to the actual incidence of visual loss in prone-positioned spinal surgery. However, our study draws upon a realistic distribution of spinal surgical cases in a typical non specialized unit in a district general hospital in the United Kingdom over an extended period of time. This cohort of patients had many of the risk factors known to predispose for visual loss in prone position spinal surgery. However, none developed any serious complications except periorbital bruising despite requiring interventions of long duration. Because the

Table 1 Inclusion criteria

| Age - 18 |
| Spinal pathology requiring surgery in the prone position (spinal fusion with or without decompression/bone graft) |
| Operation time - greater than 2 hours |

Table 2 Exclusion criteria

| Procedures performed using anterior approach |
| Isolated microdiscectomy/discectomy, isolated decompression or a combination of both |
| Removal of spinal metalwork in prone position |
| Facet joint injections/caudal epidural anaesthesia in prone position |
| Operation time - less than 2 hours |

Table 3 The American Society of Anesthesiologists Task Force on Perioperative Blindness (2006) Guidelines

Preoperative patient evaluation and preparation

1. Ophthalmic or neuro-ophtalmic evaluation (considered but not recommended)
2. Assessment of risk factors for vision loss and informing patients of risk factors

Intraoperative management

1. Blood pressure management (deliberate hypotensive techniques)
2. Management of intraoperative fluids (eg: use of colloids, crystalloids, central venous pressure monitoring)
3. Management of anaemia (monitoring of haemoglobin, haematocrit)
4. Use of vasopressors
5. Patient positioning (maintenance of neutral forward position)
6. Use of staged spine surgical procedures

Postoperative management

1. Assessing a high-risk patient's vision when the patient becomes alert
2. Optimizing haemoglobin or haematocrit levels, haemodynamic status, and arterial oxygenation
3. Magnetic resonance imaging
4. Use of antiplatelet therapy, steroids, intraocular pressure-lowering agents (considered but not recommended)
operations performed are usually aimed at patients with severe and chronic spinal degeneration, the incidence of comorbidity was unusually high in our cohort. The type of intervention itself entails significant blood loss and predisposes for optical ischaemia. The patient group studied can therefore be considered a high risk group for the development of postoperative visual loss. The fact that no case of permanent or transient vision loss occurred in our study despite the high number of predisposed patients in the group, must be interpreted as a success of our perioperative precautions. For obvious ethical reasons, no study can compare a group of patients undergoing spinal surgery equipped with protection and another group without it.

Conclusion
There is an increased risk for development of perioperative visual loss in patients who undergo spine procedures while they are positioned prone and receiving general anaesthesia. Perioperative preventative measures were found to be sufficient to prevent any form of ocular complication in our small, yet high-risk patient group. Further research will have to test and develop these precautions in a larger patient population. All patients should be informed of this risk preoperatively. However, our study suggests that it is legitimate to reassure patients of the reduced risk of ocular complications in spinal surgery when sufficient perioperative precautionary measures are taken.

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