The dangers of diagnostic laparoscopy in the head injured patient

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Summary Pneumoperitoneum during laparoscopy has been known to result in a rise in intracranial pressure (ICP) in experimental studies. There are no reports of the effect of pneumoperitoneum during diagnostic laparoscopy in patients suffering closed head injuries. We present the case of a 39 year old male with a closed head injury. Diagnostic laparoscopy was performed while intracranial pressure was monitored. ICP increased from 9 mmHg to over 60 mmHg within 10 min of pneumoperitoneum. Laparoscopy was terminated and the ICP returned to normal levels within 35 min. The authors recommend that pneumoperitoneum laparoscopy should not be used in the trauma setting where head injury is suspected. © 2002 Published by Elsevier Science Ltd.

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INTRODUCTION

Carbon dioxide (CO_2) pneumoperitoneum during laparoscopy has been known to result in a rise in intracranial pressure (ICP) in large animal models.[1,2] However, there are no reports of the effect of pneumoperitoneum for diagnostic laparoscopy in trauma patients with closed head injuries. It is yet to be investigated how the probable increase in ICP during pneumoperitoneum affects the outcome of such patients with already increased ICP. We discuss a recent case of significantly increased ICP during diagnostic laparoscopy.

CASE REPORT

A 39 year old male presented following a high speed motor vehicle accident. He had a presenting Glasgow Coma Scale score (GCS) of 8 and was intubated on arrival at the emergency department. Following a primary survey, he was sent for a cranial CT and cervical spine X-rays. The CT revealed a small right frontal hypodensity consistent with cerebral contusion. The basal cisterns were of normal appearance for his age. Due to haemodynamic instability, a decision was made to perform a diagnostic laparoscopy. Prior to laparoscopy a Medtronic^{TM} (Medtronic, Inc. Central Ave. N.E. Minneapolis, USA) external ventricular drain (Becker EDMS-46118) was inserted for intracranial pressure monitoring. The initial ICP was 9 mmHg.

Within 10 min of CO_2 pneumoperitoneum the intracranial pressure was noted to rise to 60 mmHg. Laparoscopy was terminated and an open exploration of the abdomen was performed 15 min later. Over the following 20 min during the laparotomy, the intracranial pressure decreased to 15 mmHg. The $PaCO_2$ did not increase significantly. Laparotomy was negative. The patient was extubated within 48 h and transferred for head injury rehabilitation within 7 days. Two months following the injury he had returned to independent living with moderate short term memory difficulties (Glasgow Outcome Scale score of 4).

DISCUSSION

Elevation of ICP during pneumoperitoneum has been predominantly studied in large animals such as pigs. The results of several studies indicate a high probability that intracranial pressure rises during pneumoperitoneum in normal animals. The mechanism of rise in ICP involves many factors. Increased intraabdominal pressure displaces the diaphragm cranially, narrowing the inferior vena cava and increasing intrathoracic pressure. This increases central venous pressure and increases intracranial pressure by increased pressure in the sagittal sinus with decreased resorption of cerebrospinal fluid.[3] The increase in intracranial pressure occurring during abdominal insufflation is contributed to by decreased absorption of CSF in the region of the lumbar cistern and the dural sleeves of spinal nerve roots.[4] Carbon dioxide peritoneal insufflation in animals has shown a significantly greater and more prolonged increase in ICP compared with Helium (He) or Nitrous Oxide (NO) peritoneal insufflation. This is most likely due to a metabolically mediated increase in cerebral perfusion as an increase in $PaCO_2$ and end tidal CO_2 and a decrease in pH were noted in animals undergoing CO_2 peritoneal insufflation.[5] There is also evidence the Trendelenberg position during laparoscopy results in a greater increase in intracranial pressure than if the patient is supine.[6]

The presented case illustrates what has long been suspected – that intracranial pressure rises during pneumoperitoneum in the head injured patient. There is only one report in the literature of the measurement of intracranial pressure during laparoscopy in humans.[7] This report involved two children with ventriculoperitoneal shunts secondary to Chiari malformation type II and showed significant increases in intracranial pressure during pneumoperitoneum. The mechanism for increased intracranial pressure in these patients is likely to differ from that in the trauma patient as increased resistance to ventriculoperitoneal shunt outflow and decreased brain compliance might contribute to the ICP rise.

The evidence in the literature and the presented case indicate that there is no indication for laparoscopy with pneumoperitoneum in the trauma patient as the rise in intracranial pressure could affect the outcome following head injury. The acute rise in intracranial pressure during pneumoperitoneum is a significant risk when performing laparoscopy on the patient with a suspected head injury. Alternative methods of diagnosing abdominal injury are gasless laparoscopy with anterior wall retraction or laparotomy with peritoneal lavage. These procedures are certainly preferred in the trauma setting.[8,9]

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REFERENCES

1. Ben-Haim M, Mandeli J, Friedman RL, Rosenthal RJ. Mechanisms of systemic hypertension during acute elevation of intraabdominal pressure. J Surg Res 2000; 91: 101–105.
2. Josephs LG, Este-McDonald JR, Birkett DH, Hirsch EF. Diagnostic laparoscopy increases intracranial pressure. J Trauma-Injury Infect Crit Care 1994; 36: 815–818.
3. Rosenthal RJ, Friedman RL, Chidambaram A, et al. Effects of hyperventilation and hypoventilation on $PaCO_2$ and intracranial pressure during acute elevations of intraabdominal pressure with CO_2 pneumoperitoneum: large animal observations. J Am Coll Surg 1998; 187: 32–38.
4. Halverson AL, Barrett WL, Iglesias AR, Lee WT, Garber SM, Sackier JM. Decreased cerebrospinal fluid absorption during abdominal insufflation. Surg Endosc 1999; 13: 797–800.
5. Schob OM, Allen DC, Benzel E, et al. A comparison of the pathophysiologic effects of carbon dioxide, nitrous oxide, and helium pneumoperitoneum on intracranial pressure. Am J Surg 1996; 172: 248–255.
6. Rosenthal RJ, Hiatt JR, Phillips EH, Hewitt W, Demetriou AA, Grode M. Intracranial pressure. Effects of pneumoperitoneum in a large-animal model. Surg Endosc 1997; 11: 376–380.
7. Uzzo RG, Bilsky M, Mininberg DT, Poppas DP. Laparoscopic surgery in children with ventriculoperitoneal shunts: effect of pneumoperitoneum on intracranial pressure – preliminary experience. Urology 1997; 49: 753–757.
8. Moncure M, Salem R, Moncure K, et al. Central nervous system metabolic and physiologic effects of laparoscopy. Am Surg 1999; 65: 168–172.
9. Este-McDonald JR, Josephs LG, Birkett DH, Hirsch EF. Changes in intracranial pressure associated with apneumic retractors. Archs Surg 1995; 130: 362–365.

Craniofacial surgery for giant frontonasal encephalocele in a neonate

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Summary A 5-day-old neonate with a frontonasal encephalocele is reported. He was referred to our institute with a swelling on the glabella not associated with cerebrospinal fluid (CSF) leak. The baby was the first born of a non-consanguinous marriage. The baby had a swelling over the glabella, 7 cm in diameter. The swelling had healthy covering with a raw area at the centre without any CSF leak. A magnetic resonance imaging scan showed a soft tissue swelling containing tissue iso-intense to normal brain. The internal bony defect was at the junction of the frontal and ethmoid bones, in front of the crista galii, in the floor of the anterior cranial fossa. The baby was operated on the 11th day after birth. A one-stage repair of encephalocele was performed, along with correction of hypertelorism and reconstruction of the nasal bridge. The postoperative period was unremarkable. The baby was discharged from hospital on the 10th postoperative day.

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INTRODUCTION

Anterior encephalocele is a rare condition, however, not infrequently encountered in south-east Asia.[1,2] These encephaloceles are usually covered with healthy skin. As a raw area frequently leads to colonization of bacteria with the risk of meningitis, emergency surgery is justified in such patients. In view of the multiple problems, proper planning for surgery is a must. We report on a neonate presenting with a giant anterior encephalocele, who underwent priority craniofacial surgery at our institute at the age of 11 days.

CASE REPORT

A 5-day-old male baby was referred to our institute with a large swelling over the glabella. The baby was a product of a non-consanguinous marriage. His birth weight was 2.5 kg and the Apgar score was normal. Examination revealed a swelling 7 cm in diameter over the glabella. The swelling was covered with healthy skin except at the centre, where excoriation was present. There was no cerebrospinal fluid (CSF) leak. The swelling was covering the nasal bone, forehead and medial halves of both eyes (Fig. 1). The degree of hypertelorism could not be determined. The head circumference was 26 cm. Both the coronal and sagittal sutures were fused.

The baby was admitted to our paediatric neurosurgery ward. Blood examination revealed normal haematological parameters. The swab taken from the raw area over the encephalocele grew *Staphylococcus aureus*, sensitive to vancomycin.

Vancomycin was started intravenously 48 h prior to surgery. A magnetic resonance imaging (MRI) scan was done T1 and T2 weighted serial sections were obtained in the sagittal and axial planes, and flair images were also obtained in the coronal plane. The study revealed a large midline frontonasal encephalocele with a lobulated sac containing dysplastic brain parenchyma (Fig. 2a,b) with associated holoprosencephaly with ventricular distortion. A small arachnoid cyst was also seen in the left anterior temporal lobe. The baby was operated on 11 days after the birth. A bicoronal craniotomy was perfomed, being careful not to lacerate the dura. The basal dura was carefully seperated from the orbital roof and the neck of the encephalocele was identified. The neck was carefully dissected in front of the crista galii. The encephalocele sac was opened and the gliosed brain was excised. The dural defect was covered by pericraniun, which was fixed to basal dura using biological (Glutis®) glue. The inner canthal distance was 4 cm. Hence, the extra bone at that region and the medial wall of each orbit was nibbled to correct the hypertelorism. The bone defect over the nasion was covered by the bone graft taken from the area in front of the fused coronal suture, which also corrected the secondary craniosynostosis and created an anterior fontanelle. The bone graft was fixed using 3-0 prolene sutures. The inner canthal ligaments on either side were fixed to the frontal bone. The