Changing trends in pituitary surgery

The development of the operating endoscope has made a significant change to the delivery of pituitary surgery over the last 10 years. The improved visualization of the operative field afforded by the endoscope is leading to decreased morbidity and possibly better results. It has also necessitated the move towards joint working between neurosurgeons and otolaryngologists, which fits well with modern multidisciplinary patient management and should lead to safer advances in extended skull base surgery in the future.

Historically development in pituitary surgery has been driven by improvements in optics. Sir Victor Horsley in 1906 performed the first successful trans-frontal craniotomy for a pituitary tumour. Herman Schloffer first described a nasal approach in 1907 but it is Harvey Cushing who is most associated with the trans-septal trans-sphenoidal approach. He started his series of cases in 1909 but abandoned this approach and reverted to a trans-cranial approach as he was struggling with postoperative infections and, not surprisingly, difficulty in visualizing the operative field when using just a relatively primitive head light.

In the 1960s the operating microscope and intraoperative fluoroscopy allowed a switch back to the per-nasal trans-septal route (Guiot and Thibant, 1959; Hardy, 1962). By using an operating microscope the surgeon gets excellent illumination, three-dimensional perception and two hands free for operating. This has been the mainstay of pituitary surgery until recently.

Otolaryngologists started using rigid endoscopes for endoscopic sinus surgery in the late 1980s and the first use in pituitary surgery was by an otolaryngologist, Jankowski and colleagues in 1992. Since then the techniques have been refined (Jho et al, 1996; Cappabianca et al, 1998).

Indications

The indications for pituitary surgery have changed little over the years. Pituitary tumours are usually benign adenomas or cysts. Approximately half present as non-secreting tumours that cause problems by local compression. Adenomas causing hyper-secretion of prolactin, growth hormone and adrenocorticotrophic hormone (Cushing's disease) make up the majority of the remainder. Prolactinomas are predominantly treated medically with dopamine agonists. Growth hormone secreting tumours can be treated with some somatostatin analogues but surgical intervention is still the mainstay of treatment. Medical treatment of Cushing's disease using a ketoconazole and metyrapone is of limited benefit and surgery is a treatment of choice.

The other treatment option for these tumours is radiotherapy. This is not suitable for large tumours (macro-adenomas) because of the risk of damage to the adjacent optic chiasm. It can be an effective treatment for smaller adenomas and hyper-secretion syndromes but can take several years to take effect and often leads to reduced pituitary function (Winder and Mayberg, 2011).

Techniques

The endoscopes used are 4 mm in diameter and give a wide-angled view of the operative site. The endoscopes are available with different viewing angles (0, 30 and 70°). The advantage over the microscope is that the surgeon can see a wide field of vision rather than being confined to a small, tunnelled view. The endoscope can be placed in the pituitary fossa after removal of tumour and a view gained laterally towards the cavernous sinuses and superiorly towards the diaphragm that forms the roof of the pituitary fossa. It is therefore much easier to see whether a tumour has been adequately cleared.

The improved visualization in the sphenoid sinus means identifying the anatomical landmarks during the approach to the pituitary fossa has improved. Access to the pituitary fossa is achieved by removing the posterior centimetre of the nasal septum and the front wall of the sphenoid sinus. This avoids the morbidity associated with the trans-septal route and less postoperative nasal packing is required. The surgical field is viewed on a monitor. The 'two surgeon, four handed' technique means that the surgeon can hold the endoscope and position one instrument up one nostril while the assisting surgeon can introduce up to two other instruments up the other nostril.

Results

The hopes of the early adopters of this technique that the improved visualization would result in less morbidity and better results seem to be bearing fruit.

Meta-analyses (Tabaee et al, 2009; Goudakos et al, 2011) have shown that the endoscopic approach does give good, safe, reliable results. These studies indicate that there is a lower morbidity in the form of complications such as CSF leaks, synechiae and less need for postoperative packing. Length of stay is also less with the endoscopic techniques.

The improvement in visualization inside the pituitary fossa should logically lead to better long-term results in terms of tumour removal and better control of hyper-secretion syndromes. Pituitary adenomas grow slowly and recurrence after surgical intervention is common but often delayed, so studies comparing results are few and are difficult to conduct. Despite this a review and analysis of studies by Dorward (2010) appears to back up these hopes.

Recent advances in surgical navigation have also helped. The image intensifier was previously used but this only gives improved orientation in a two-dimensional plane. More modern surgical navigation techniques using magnetic or infrared systems allow three-dimensional orientation peroperatively. The position of the tip of a pointer placed in the surgical field is displayed in the three dimensions of the patient's preoperative computed tomography and magnetic resonance scan. These techniques are useful in complex and revision cases but the improved visualization of the normal landmarks means that they are often not necessary in straightforward cases.

Who should be doing this surgery?

Since the 1960s pituitary surgery has been done predominantly by neurosurgeons in the UK with a few centres where otolaryngologists were the primary surgeons. The

surgical skills required for access to the pituitary fossa are relatively standard in modern otolaryngology training. There is more of a learning curve to be negotiated by the neurosurgeons wishing to acquire the endoscopic skills but the big advantage of this change in working patterns is that both specialties are increasingly working together. This has had the knock-on advantage of increasing the scope of endoscopic skull base surgery beyond that of 'simple' pituitary surgery. Increasingly other pathologies in the sella region are being tackled such as meningiomas, craniopharyngiomas and chordomas. In addition similar per-nasal techniques with wider surgical approaches through the ethmoids are being used to gain access to anterior cranial fossa tumours, lesions of the orbital apex and the clivus.

Pituitary surgery works well with a multidisciplinary approach. Multidisciplinary teams in this field need to include the endocrinologists, oncologists and surgeons as a minimum. In the author's view joint input from otolaryngologists and neurosurgeons leads to the best outcomes and is the way forward.

Future trends

Future developments currently being evaluated also promise hope of improved results. There is increasing discussion of extracapsular dissection whereby the whole of an adenoma is removed in one piece rather than being curetted out piecemeal (Oldfield and Vortmeyer, 2006). This necessitates a more widespread exposure of the surgical field which may have associated morbidity but may also improve the long-term surgical outcomes. Intraoperative magnetic resonance and computed tomography imaging may help with tumour clearance.

Three-dimensional endoscopes are also being developed. These endoscopes would give a three-dimensional view on a screen and help the surgeon assess the depth of field. Stereotactic radio surgery in the form of the gamma knife or cyber knife also appears to give advantages in terms of improved control of hyper-section and a decreased reduction in residual pituitary function over conventional radiotherapy.

Conclusions

Endoscopic, endonasal approaches to the pituitary fossa and the rest of the anterior skull base are being increasingly adopted as they lead to reduced morbidity and potentially improved results. Increasing joint working between neurosurgeons and otolaryngologists is expanding the possibilities and scope for skull base surgery. BJHM

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KEY POINTS

- Technical advances in pituitary surgery continue to be driven by improvements in visualization of the operative field.
- Endoscopic techniques have less complications and reduced morbidity compared to microscopic techniques.
- The operating endoscope allows the surgeon to see inside the pituitary fossa, laterally towards the cavernous sinuses and superiorly towards the diaphragmatica sellae and thus aiding tumour clearance.
- Surgery involving the combined skills of otolaryngologists and neurosurgeons is increasingly common and likely to give the best results.