Recent Advances in Minimally Invasive Endocrine Surgery

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Introduction

Over the past decade, minimally invasive surgery has become the standard in many areas of general surgery; endocrine surgery is no exception. The principles and techniques of minimally invasive surgery were first applied very successfully in laparoscopic adrenalectomy and soon spread to surgery of the parathyroid, thyroid and endocrine pancreas with varying degrees of success and acceptance. In this issue of the Journal are four articles on “Recent Advances in Minimally Invasive Endocrine Surgery”, each written by recognized experts in the field. These authors, from Japan, Hong Kong and Australia, are at the forefront of minimally invasive surgery, developing and evaluating new techniques and approaches for surgery for the endocrine glands. These excellent papers review and summarize for us the rationale, indications, contraindications, techniques in this field and, most importantly, their results as well as those of other experts. Below is a brief overview of the current status of minimally invasive endocrine surgery from my own perspective.

Adrenal

Laparoscopic adrenalectomy is now the gold standard surgery for most surgical diseases of the adrenal gland. It has replaced open adrenalectomy for the resection of all aldosteronomas, smaller phaeochromocytomas, adrenal adenomas causing Cushing’s syndrome and adrenal hyperplasia in patients with adrenocorticotrophic hormone (ACTH)-dependent Cushing’s syndrome whose source of ACTH cannot be controlled. Laparoscopic adrenalectomy is obviously not indicated for very large tumours that are difficult to resect, or invasive adrenocortical cancers that are rarely curable and likely to recur. It is controversial whether or not laparoscopic adrenalectomy can be performed safely, without risking local recurrence, for small adrenocortical cancers or solitary metastases to the adrenal glands. Institutional experience and surgeons’ judgement are used to guide the appropriate treatment.

There are several safe and effective approaches for laparoscopic adrenalectomy. The lateral transabdominal approach popularized by Gagner is the approach most commonly used by general surgeons. This approach is relatively versatile for various types of adrenal diseases and is easier to learn for surgeons who perform other laparoscopic operations. A few surgeons prefer the anterior transabdominal approach, and others the posterior or lateral retroperitoneal approach. Urologists usually favour the latter, because they are more comfortable with the retroperitoneal anatomy. Each approach has its own proponents who have shown it to be safe and effective. In general, the best approach is the one with which the surgeon has the most experience.

Other areas of controversy in surgery of the adrenal gland have persisted from the era of open adrenalectomy. Some have been highlighted by the advances in laparoscopic adrenalectomy. One controversy involves the indications, risks and effectiveness of subtotal (or partial, or cortex-sparing) adrenalectomy, which can now be safely performed for benign adrenal tumours with low risk of haemorrhage. Another controversy is the indication for surgical resection of adrenal incidentalomas that are not functioning. There is a growing trend to lower the threshold of tumour size (from 5–6 cm to 3–4 cm) for resection, because of the lower morbidity associated with laparoscopic adrenalectomy.

Parathyroid

Minimally invasive surgery of parathyroid tumours became feasible with advances in localization studies, particularly...
Minimally invasive techniques for parathyroid surgery are best applied in patients who have been selected as most likely to have a single adenoma that is definitively localized. Patients with multiple gland disease are more likely to have negative, discordant or equivocal localization studies, whereas those with scans showing a concordant single positive lesion almost always have a single adenoma. These preoperative localization studies, which were considered a luxury when generalized four-gland exploration was the norm, have become necessary before the initial focused parathyroid exploration. This “scan-selected” and “scan-directed” focused approach to parathyroidectomy has become the standard in many centres.

While the concept of “scan-selected” and “scan-directed” focused parathyroidectomy is well accepted, there is no consensus for the best technique for minimally invasive parathyroidectomy. Even the definition of “minimally invasive” parathyroidectomy is debated. The minimally invasive techniques have in common shorter skin incision and less tissue dissection compared with traditional parathyroid exploration. Some techniques use the endoscope while others do not. The former include the totally endoscopic approach from a central neck access (Gagner/Mount Sinai) or from a lateral neck access (Henry/Marseille), and the endoscope-assisted approach from a central neck access (Miccoli/Pisa). After some initial enthusiasm, the intraoperative gamma-probe sestamibi-guided technique (Norman/Tampa) is now rarely used. In contrast, the technique of direct dissection through a minimal incision, either through a lateral or a central neck approach, guided by preoperative localization studies and confirmed by intraoperative parathyroid hormone monitoring, has gained the most significant acceptance. Each of the above techniques has been shown to be relatively safe and effective by its proponents. They mainly differ in where the incisions are placed, the ease of learning and the need for special instruments. Although these techniques continue to evolve, the current favourite seems to be focus exploration by direct dissection through a minimal incision, because it is the most versatile and easy to learn.

**Thyroid**

Minimally invasive surgery of the thyroid gland is the area of most recent development and is associated with the most controversy. The concept of minimally invasive thyroid surgery is the least accepted compared with that for the adrenal and parathyroid glands. The main issues that hinder the development of minimally invasive thyroid surgery relate to the indications for operation. The most common indications for thyroidectomy are large goitres and thyroid cancers, yet both are relative contraindications for most techniques of minimally invasive thyroid surgery. Large goitres are difficult to dissect. Thyroid cancers usually require complete excision of all thyroid tissue and sometimes require lymphadenectomy. There are also concerns about the risk to the recurrent laryngeal nerve, superior laryngeal nerve and the parathyroid glands. Surgeons experienced in these techniques, however, have shown that the nerves and parathyroid glands can be protected. Some have also shown that complete removal of the thyroid gland can be achieved, as proven by postoperative low levels of serum thyroglobulin and minimal radioactive iodine uptake. The technique that has been most studied is the endoscope-assisted central neck access approach, MIVAT (minimally invasive video-assisted thyroidectomy; Miccoli/Pisa, Yeung/Hong Kong). Some have used the lateral neck access (Inabnet-Gagner/Mount Sinai, Huscher/Rome). Other surgeons, especially in Asia, have developed techniques that avoid a neck incision by access through the chest (Shimizu/Tokyo) or the axilla (Takami/Tokyo). These techniques are evolving. Currently, only a fraction of patients undergoing thyroidectomy are candidates for minimally invasive thyroid surgery.

**Conclusion**

There are several common themes in minimally invasive endocrine surgery that are emphasized in the following excellent papers by our expert authors: 1) proper patient selection is crucial to good results; 2) the tumour needs to be clearly localized before the operation; 3) invasive cancers and very large tumours are currently relative contraindications; 4) multiple tumours are usually available, but consensus may emerge as to which is the most versatile technique for each endocrine gland; 5) surgeon and institutional experience is of paramount importance in the choice of specific surgical technique; and 6) good prospective studies are sorely needed to evaluate these techniques. This is an exciting time to be an endocrine surgeon, as we witness the increasing understanding of endocrine diseases and the rapidly developing techniques of minimally invasive endocrine surgery.