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**CONTEMPORARY MINIMALLY INVASIVE SURGERY FOR ADRENAL MASSES:
IT'S NOT ALL ABOUT (PURE) LAPAROSCOPY**

Nicola Pavan^a, Ithaar Derweesh^b, Jens Rassweiler^c, Benjamin Challacombe^d, Homayoun Zargar^e,
James Porter^f, Evangelos Liatsikos^g, Jihad Kaouk^h, Francesco Porpigliaⁱ, Riccardo Autorino¹

^aUrology Clinic, Department of Medical, Surgical and Health Science, University of Trieste, Italy;

^bDepartment of Urology, UC San Diego Health System, La Jolla, California; ^cDepartment of Urology, SLK

Kliniken Heilbronn, University of Heidelberg, Heidelberg, Germany; ^dGuy's and St Thomas' Hospitals,

London, UK; ^eDepartments of Urology and Surgery, Royal Melbourne Hospital, Melbourne, Vic.,

Australia; ^fSwedish Urology group, Seattle, WA; ^gDepartment of Urology, Medical School, University of

Patras, Patras, Greece; ^hGlickaman Urological Institute, Cleveland Clinic, Cleveland, OH, USA; ⁱDivision

of Urology, Department of Oncology, University of Turin "San Luigi" Hospital, Orbassano, Italy; ¹Urology

Institute, University Hospitals, Case Western Reserve University, Cleveland, OH, USA

Corresponding author:

Riccardo Autorino, MD, PhD, FEBU

Associate Professor of Urology, Case Western Reserve University

University Hospitals Urology Institute

27100 Chardon Rd, Richmond Heights, OH, 44143, USA

riccardo.autorino@UHhospitals@org; ricautor@gmail.com

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A quarter of century has elapsed since the first described laparoscopic adrenalectomy (LA), and since then, minimally invasive surgery for the management of adrenal masses has come a long way: indications have expanded, techniques have evolved, and data have matured.

Ball et al recently reported an evidence-based systematic review on the use of minimally invasive adrenalectomy as part of the International Consultation on Urological Diseases and European Association of Urology consultation [1]. Notably, the authors included 52 comparative studies in their analysis, published up to 2014, and they provided the following recommendations: laparoscopy should be first line therapy for benign adrenal masses (Grade B), and pheochromocytoma (Grade B), whereas it should be regarded as feasible option for select adrenocortical carcinoma cases (those without adjacent organ involvement) (Grade C). They also pointed out that transperitoneal and retroperitoneal approaches are equally effective, and one or the other should be chosen based on surgeon training and experience (Grade A). Moreover, they mentioned LESS (grade C) and robot-assisted laparoscopy (grade B) as alternatives requiring further study. While commending the authors for this comprehensive analysis, we would like to take this opportunity to contribute to the discussion by addressing few key issues.

As for other more common surgical indications, the use of minimally invasive surgery (MIS) for adrenalectomy is gaining momentum. This has been demonstrated by large population-based studies, such as the one by Monn et al., who looked at national trends for adrenalectomy in the US during the time period 2002-2011 using the Nationwide Inpatient Sample [2]. A MIS approach was used in 20% of the 58,948 adrenalectomies included in the analysis, with a 4% increase in MIS throughout the study period ($p < 0.001$). “Real life” data have been recently reported by Pavan et al, confirming this trend [3]. The authors performed a retrospective multi-national multi-center study of 737 minimally invasive adrenalectomy cases performed over a 5 year period (2008-2013) at fourteen Urology Institutions worldwide. While a large cohort of cases (46%) were laparoscopic, other techniques had been implemented, such as laparoendoscopic single site surgery (LESS) (36% of cases), robot assisted laparoscopy (RAL) (11%), and mini-laparoscopy (ML) (8%). Interestingly, European centres mostly adopted laparoscopy and mini-laparoscopy techniques, whereas those from Asia and South America reported the highest rate LESS procedures, and RAL was more frequently adopted in the US. This study represents one of the very few multi-institutional series reported in

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urology, and we believe it raises some interesting points for discussion. Firstly, in a literature that is largely dominated by reports from endocrine (general) surgery it confirms that minimally invasive adrenalectomy can be safely and effectively performed by urologists that are proficient in MIS. Secondly, minimally invasive adrenalectomy is a “live” field of clinical research, where new techniques are being tested, with the ultimate aim of becoming even less invasive than standard laparoscopy. LESS adrenal surgery has been embraced by several groups for a number of different indications and using a variety of approaches. The rationale for using LESS for adrenalectomy stems from the fact that this is a purely extirpative procedure with a small specimen (requiring a small incision for extraction); on the other hand, challenges exist from the unique anatomical location of the adrenal gland. In a recent meta analysis of 10 studies (over 700 cases), Wu et al found LESS adrenalectomy to be a safe and feasible alternative to laparoscopy, with the potential for a shorter length of hospital stay and lower postoperative pain [4]. It is most commonly being used in populations with low body mass indices (BMI) where LESS access may be easier. Recently, ML has been rediscovered as part of the efforts towards a virtually "scarless" surgery. Its re-discovery has been fuelled by development of more reliable instrumentation and by the fact that ML allows minimal abdominal scar while preserving the key principle of triangulation. Interestingly, Pavan et al found the retroperitoneoscopic route to be the most used for ML adrenalectomy [3]. The debate regarding transperitoneal versus retroperitoneal approaches will continue to exist due to surgical preference, experience and training.

Utilization of RAL has exponentially grown in urology following its large scale use for radical prostatectomy. Consequently other urological indications for robotic surgery are gaining momentum, including that of adrenalectomy. A recent systematic review and meta-analysis of 9 studies (600 patients) suggested potential advantages (over standard laparoscopy) including a shorter hospital stay, less blood loss, and lower occurrence of postoperative complications [5]. Recently published Society of Gastrointestinal and Endoscopic Surgeons (SAGES) guidelines support the use of RAL in patients with high BMI, as well those with larger tumors (**Figure 1**). Extra expense related to the use of robotic technology remains an ongoing issue in the current financial era but if already purchased the robotic approach becomes cheaper. To this regard, recent data reported in the BJUI seem to suggest that robotic adrenalectomy can become cost effective (when compared to its open counterpart) if done at high volume centres [6].

Finally, looking specifically at the treatment of adrenocortical carcinoma where the role of MIS still remains secondary; a recent meta-analysis of 9 comparative studies (240 laparoscopic and 557 open cases) found hospitalization time favoured laparoscopy, with no differences in terms of overall recurrence rate, time to recurrence and cancer-specific mortality. However the risk of peritoneal carcinomatosis was higher for LA (RR 2.39; CI 1.41, 4.04; p = 0.001). The authors concluded that open should still be considered the standard surgical management in this setting, but

laparoscopy may play a role in carefully selected cases without jeopardizing oncological outcomes [7]. Similar conclusions were drawn by Maurice et al in a recent analysis of 481 patients from the National Cancer Database [8]. They concluded that minimally invasive adrenalectomy can offer comparable surgical quality to open, while expediting inpatient recovery, but open holds superior outcomes for locally advanced disease.

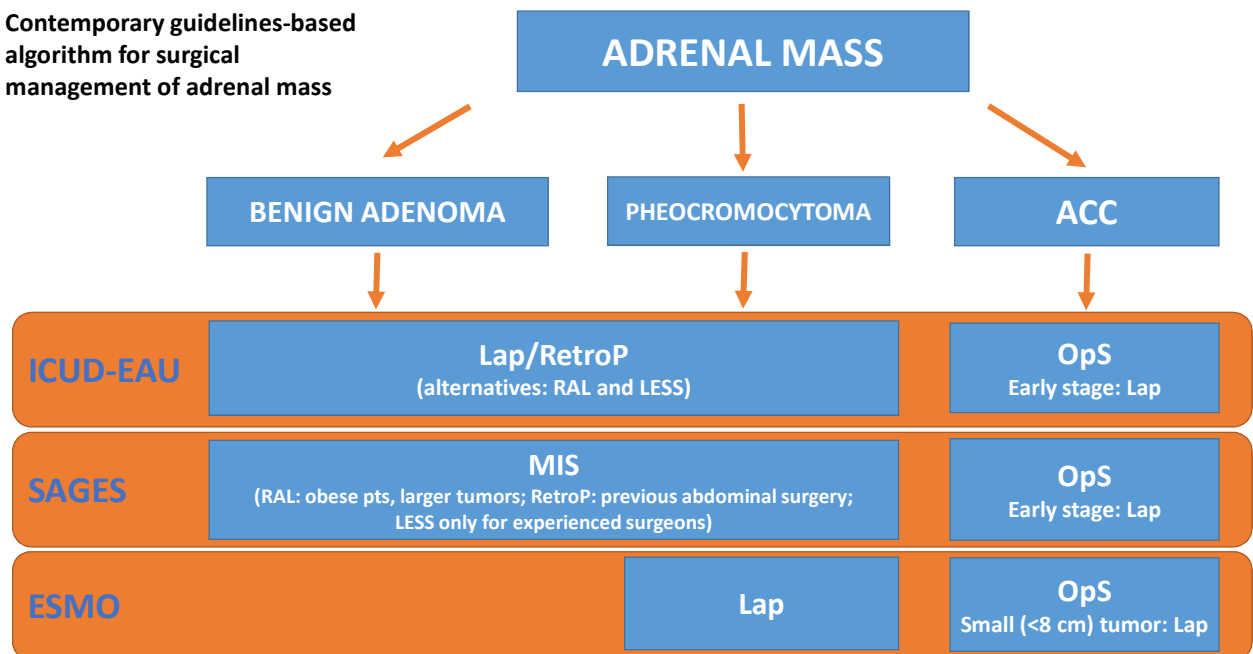
In conclusion, the surgical management of adrenal masses remains an interesting area for discussion. Maturing evidence, from both the urological and general surgical literature alike, shows that MIS plays a major role for the vast majority of adrenal pathologies, with a caveat for adrenal cancer (**Figure 1**). While standard laparoscopy remains the default approach in this area, other minimally invasive options are on the rise, expanding our surgical armamentarium and shaping the range of options we can offer to our patients.

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Contemporary guidelines-based algorithm for surgical management of adrenal mass



LEGENDS: ACC=Adrenocortical carcinoma; Met=Metastasis; Lap=Standard laparoscopy; RetroP=Retroperitoneoscopy; MIS=Minimally invasive surgery; Op=Open surgery; RAL=Robot assisted laparoscopy; LESS=Laparoendoscopic single site surgery; ICUD=International Consultation Urological Disease; EAU=European Association of Urology; SAGES=Society American Gastrointestinal Endoscopic Surgeons; ESMO: European Society Medical Oncology