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UPPER TRACT SURGERY
REVIEW

Laparoscopic renal surgery is here to stay

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KEYWORDS

Laparoscopic/open/robotic renal surgery;
Radical nephrectomy;
Donor nephrectomy;
Partial nephrectomy;
Pyeloplasty

ABBREVIATIONS

BMI, body mass index; (L)(LESS-)DN, (laparoscopic) (lapar-

Abstract ***Objectives:*** To review the current literature comparing the outcomes of renal surgery via open, laparoscopic and robotic approaches.

Materials and methods: A comprehensive literature search was performed on PubMed, MEDLINE and Ovid, to look for studies comparing outcomes of renal surgery via open, laparoscopic, and robotic approaches.

Results: Limited good-quality evidence suggests that all three approaches result in largely comparable functional and oncological outcomes. Both laparoscopic and robotic approaches result in less blood loss, analgesia requirement, with a shorter hospital stay and recovery time, with similar complication rates when compared with the open approach. Robotic renal surgeries have not shown any significant clinical benefit over a laparoscopic approach, whilst the associated cost is significantly higher.

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oendoscopic single-site-) donor nephrectomy;
eGFR, estimated GFR;
LOS, length of hospital stay;
NOTES, natural orifice transluminal endoscopic surgery;
(L)(O)(RA)PN, (laparoscopic) (open) (robot-assisted) partial nephrectomy;
PUJO, PUJ obstruction;
(L)(O)(RA)PY, (laparoscopic) (open) (robot-assisted) pyeloplasty;
RCT, randomised controlled trial;
(L)(O)(RA)RN, (laparoscopic) (open) (robot-assisted) radical nephrectomy;
WIT, warm ischaemia time

Conclusion: With the high cost and lack of overt clinical benefit of the robotic approach, laparoscopic renal surgery will likely continue to remain relevant in treating various urological pathologies.

Introduction

Laparoscopy in humans was first performed >100 years ago by the Swedish surgeon Hans-Christian Jacobaeus; to which he originally named the technique *laparothorakoskopie* [1]. Initially only performed for diagnostic purposes, several landmark innovations over the last century, such as the Trendelenburg position and the Hopkins rods-lens system, have paved the way for more complex operations to be performed via a laparoscopic approach [2].

The first laparoscopic renal surgery was performed in 1990 by Clayman et al. [3] from Washington, USA; in the *New England Journal of Medicine* they described the first case of laparoscopic nephrectomy, which involved a 7-h operation on an 85-year-old woman's 3-cm solitary right renal mass. As laparoscopic nephrectomy became more widespread, more advanced and complicated procedures were developed. In 1995, the first series of partial nephrectomies (PNs) was published by Winfield et al. [4], and in Johns Hopkins University the first laparoscopic donor nephrectomy (LDN) was performed by Su et al. [5]. Whilst the propagation of laparoscopic renal surgery was initially hampered by a significant learning curve and longer operation time, as more experience was accumulated new evidence showed laparoscopic outcomes to be comparable to an open approach, with the added advantage of significantly less blood loss, analgesia requirement, and length of hospital stay (LOS) [2,6].

Laparoscopic nephrectomy is now routinely performed for both benign and malignant pathologies, as well as DNs in renal transplantation. Laparoscopic PN (LPN) has also seen widespread use, as nephron-sparing surgery has been set as the 'gold standard' for managing small renal tumours. In centres with laparoscopic expertise, laparoscopic pyeloplasty has been increasingly performed for PUJ obstruction (PUJO).

With the advancement of robotic surgery, urology has been at the forefront in this regard, particularly for pelvic surgeries such as robotic prostatectomies [7]. Much interest has been shown in applying the robotic system to renal surgery, with its advantages of improved ergonomics, dexterity, and reduced physical strain on the operating surgeon [8]. However, to date, the cost of robotic systems remains a major stumbling block in widely implementing them; whilst there are limited comparative studies demonstrating out-right improvements in outcome when compared with established techniques.

The present review aims to gather evidence on relevant outcomes of renal surgeries (in particular, nephrectomy, PN, and pyeloplasty) performed via open, laparoscopic and robotic approaches, to ascertain