One hand is better than two: conversion from pure laparoscopic to the hand-assisted approach during difficult nephrectomy

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ABSTRACT

INTRODUCTION The incidence of conversion from a laparoscopic to an open approach during nephrectomy is reported at 6–8%.¹ Conversion to an open procedure may be necessary to control haemorrhage or allow progress in dissection but the well established benefits of minimally invasive surgery (MIS) are obviously lost. Hand-assisted laparoscopy (HAL) also offers the benefits to the patient of MIS. We have used HAL to convert from the pure laparoscopic approach during difficult nephrectomies, rather than converting to traditional open surgery.

MATERIALS AND METHODS A review of our prospective database was carried out to identify any conversions from the pure laparoscopic approach during nephrectomy or nephroureterectomy for benign or malignant disease.

RESULTS A total of 87 laparoscopic nephrectomies (LNs) were identified over a 3-year period. There were five conversions to the HAL approach (5.7%) and no conversions to open surgery. The reason for conversion was failure to progress in all five cases. Operative times averaged 190 minutes with blood loss of 180ml. Histology revealed xanthogranulomatous pyelonephritis in four cases and renal cell carcinoma in one case. The median postoperative stay was 4 days.

CONCLUSIONS Conversion to HAL during LN maintains the benefits of MIS in difficult nephrectomy and should be considered prior to converting to open surgery.

KEYWORDS

Laparoscopy – Nephrectomy – Hand assisted – Conversion

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Hand-assisted laparoscopy (HAL) is a widely used technique across many specialties, with its practice extending from complex hysterectomies in gynaecology² to sigmoidectomies in general surgery.⁵ Providing the benefits of minimally invasive surgery (MIS)⁴ with the ability to introduce a surgeon's hand into the operative field, the allure of HAL has led to its uptake in a variety of urological procedures.

In 1996 Bannenberg *et al* first demonstrated the urological applications of HAL in the porcine model, performing the first HAL nephrectomy.⁵ Nakada *et al* provided the next step in the evolution of HAL, conducting the first human HAL nephrectomy in the following year.⁶ Using the Pneumo Sleeve device (Dexterity, Atlanta, Georgia, US), the group identified HAL to be an adjunct of great potential in laparoscopic surgery.

Proponents of HAL maintain that the presence of a surgeon's hand provides better haemodynamic control, tactile

feedback and recourse to finger dissection. The combination of these elements can contribute to faster operative times when compared with standard laparoscopy in nephrectomies.⁴ However, opponents argue that a virtuoso laparoscopic surgeon should achieve completion times approaching that of HAL⁷ and that it does not offer any significant benefit over pure laparoscopy in the convalescence of the patient.⁸ Rather, it is reported that there is an increase in the number of complications with the use of HAL.⁹

We herein explore the use of HAL as opposed to conversion to open surgery in difficult cases of standard laparoscopic nephrectomies (LNs).

Materials and Methods

Prospective data were collected on all laparoscopic cases performed in our unit. We reviewed these data to identify

any conversions from the pure laparoscopic approach during nephrectomy or nephroureterectomy for benign or malignant disease. Cases were selected from a three-year period between 2007 and 2009.

The GelPort® (Applied Medical, Rancho Santa Margarita, California, US) is a straightforward device to use and all surgeons, with a combined experience of over 100 HAL nephrectomies, were familiar with it prior to these cases. Two of the team (PD and DGM) have participated in instructional courses for hand-assisted laparoscopic nephrectomy and have extensive experience with its use. GelPort® is used for all donor nephrectomies in our institution.

Results

Over a 3-year period, 87 LNs were identified. There were five conversions to the HAL approach (5.7%) and no conversions to open surgery.

All of these five LNs had started via the retroperitoneum using balloon dissection followed by insertion of three ports. This is a standardised approach well described in literature. In these five cases a GelPort® device was inserted by extending the anterior port to 7cm, allowing an assistant to introduce his hand. The camera remained in the central port below the tip of the 12th rib, and dissection and hilar control was performed by the surgeon through the posterior port (Fig.1).

The reason for conversion was failure to progress in all five cases. Operative times averaged 190 (range: 120–210) minutes with estimated blood loss of 180ml. Histology revealed xanthogranulomatous pyelonephritis in four cases and renal cell carcinoma (8cm) in one case. The median postoperative stay was 4 days with the patients suffering no additional complications.

Discussion

HAL combines the advantages from both open surgery and laparoscopy, allowing the surgeon to maintain tactile sensation, which may help reduce the risk of injury to surround-

ing structures, particularly when tissue planes are difficult to develop such as in nephrectomy for xanthogranulomatous pyelonephritis. Of the 87 nephrectomies that we performed, 5 were converted to the HAL approach, in cases where there was a failure to progress. Open surgery was not required in any of the procedures. Recovery time was minimised to 4 days as the benefits of MIS remained.

It is well documented that the recovery times associated with HAL are congruent with those of LN. In a study of 21 nephrectomies consisting of 13 HAL and 8 LN procedures, Wolf *et al* reported similar hospital stay and time to resumption of normal activities.⁴ In the HAL group, patients required a mean of 3.1 days in hospital and 14 days before they were able to undertake normal activities. The LN patients had hospital stay and recovery time of 3 days and 10 days respectively. There was no significant difference between the two groups, indicating that the introduction of the surgeon's hand through a small incision had not had an adverse effect on convalescence and recovery.

Nelson and Wolf also described similar findings in their retrospective study comparing 22 HAL nephrectomies with 16 laparoscopic approaches.¹⁰ They reported mean estimated blood loss at 191ml versus 289ml ($p=0.5809$), hospitalisation at 2.7 versus 2.4 days ($p=0.6257$) and mean return to work at 35 versus 25 days ($p=0.3051$) for HAL and standard laparoscopy respectively. A similar pattern emerged in their results for mean time to ambulation, analgesic use and mean pain scores. This indicates comparable outcomes between HAL and laparoscopic procedures.

Conversion to open surgery following an initial laparoscopic approach may reduce the need for a large incision compared with that of *de novo* open surgery. However, our experience in these cases was that the dissection remained very challenging, even after conversion to HAL, and therefore a generous incision would have been required if a conversion to open surgery had taken place. Moreover, evidence from donor nephrectomy series demonstrates that HAL nephrectomies offer reduced hospital stay and analgesia requirements when compared with open nephrectomies, emphasising the minimally invasive benefits of this approach.^{11,12}

HAL is considered by its proponents to be a feasible and practical primary surgical approach. The shorter operative time with HAL nephrectomy is frequently highlighted as one of its benefits.^{4,10} Among 15 HAL procedures performed by Wolf *et al* in one study, the group achieved a mean operative time of 240 minutes, significantly less than the 325-minute average for 8 LNs.

Although HAL provides many of the advantages associated with MIS, there remains significant opposition to its use as the primary surgical approach. Opponents maintain that the advantages of HAL do not sufficiently improve over LN and, as such, pure laparoscopy remains the favoured approach to nephrectomy. While Nelson and Wolf stated that LN was more time consuming than HAL at 270 minutes compared with 205 minutes ($p=0.0004$), they mentioned that the operative times for LN can be significantly improved with experience.¹⁰ Dividing their study into two halves, the group found that operative times decreased from 293 to 232

minutes ($p=0.0445$) between the halves in the laparoscopic group, with no such improvement seen in HAL throughout the same period.

More recently, Bargman *et al* analysed 40 donor nephrectomies in a randomised control study, involving equal numbers undergoing LN and HAL.¹⁵ With mean operative times of 200 and 219 minutes ($p=0.02$) for LN and HAL respectively, they demonstrated that LN can be quicker than HAL. Furthermore, there are reports of an increase in complications when using HAL, with a risk of wound complications. In a group of 13 patients who underwent HAL nephrectomies for malignant kidney disease, 5 cases experienced major wound complications or required conversion to open surgery.⁹ These results prompted the authors to abandon the use of HAL and revert to the use of standard laparoscopy for nephrectomies.

There have also been other reports of inherent device failures associated with older HAL devices.⁸ However, the newer devices, particularly the GelPort®, have significantly improved on reliability¹⁴ and are associated with lower rates of wound complications.¹⁵ In addition, HAL devices are expensive and may deter surgeons from opting for this method, particularly when weighed against similar outcomes experienced with standard laparoscopy.¹⁶ The combination of increased wound complications, reliability and expense associated with HAL, as well as the potential for improved operative times with standard laparoscopy, make the latter a more suitable first choice for nephrectomies.

Nevertheless, using HAL to salvage a difficult case requires surgeon familiarity and availability of the device. HAL itself is reported to have a learning curve and some have supported its use only by experienced laparoscopic surgeons.⁸ However, instructional courses are available and further recourse from HAL procedures to open procedures still remains a viable option during the learning process. There must also be acceptance of initial training costs and expenses related to the procurement and use of the HAL device. The shorter use of operating theatres due to faster operative times may go some way in reducing this cost.¹⁷ Furthermore, the quicker recovery time experienced with HAL compared with open procedures reduces the length of stay and may additionally contribute to subsidising such costs.¹¹

While HAL may not present a viable option as a primary surgical approach, it may have a role in conversion from difficult and complicated laparoscopic cases, before resorting to open surgery. Conversion to the open approach provides the surgeon with reassurance when the procedure is more complex than initially envisaged. It also offers faster operative times in comparison with both HAL and standard laparoscopy.¹² The disadvantage is a longer recovery period. We have therefore considered HAL for conversion from LN while keeping open surgery in reserve should it become necessary.

Conclusions

From this limited initial experience, HAL appears to be a safe, effective and feasible procedure in cases of difficult

LN requiring conversion. Maintaining the benefits of MIS, it should be considered prior to an open conversion.

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