Perioperative, functional and oncological outcomes after open and minimally invasive prostate cancer surgery: experience from Australasia

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OBJECTIVE

• To systematically review the current literature concerning perioperative, functional and oncological outcomes reported after open and minimally invasive prostate cancer surgery specifically from institutions within Australasia.

RESULTS

• Overall, the data are limited by the low methodological quality of available studies.
• Only two comparative studies evaluating open radical prostatectomy (ORP) and robotic-assisted laparoscopic RP (RALP) were identified, both non-randomized.
• The mean blood loss, catheterization time and hospital stay was shorter after RALP than with ORP. In contrast, mean operative procedure time was significantly longer for RALP.
• Overall adverse event rates were similar for the different surgical approaches although the rate of bladder neck stricture was significantly higher after open RP.
• Incorporation of patient outcomes achieved by surgeons still within their learning curve resulted in a trend towards higher positive surgical margin rates and lower continence scores after RALP. However, there was equivalence once the surgeons’ learning curve was overcome.

CONCLUSIONS

• Few comparative data are available from Australasia concerning open and minimally invasive prostate cancer surgery.
• While perioperative outcomes appear to favour minimally invasive approaches, further comparative assessment of functional and long-term oncological efficacy for the different surgical approaches is required to better define the role of minimally invasive approaches.

KEYWORDS

Australasia, laparoscopic, outcomes, prostate cancer, radical prostatectomy, robotic

INTRODUCTION

Prostate cancer is now the most common cancer diagnosed in both Australia and New Zealand, a trend mirrored in many other developed countries. Each year almost 20 000 men in Australia and a further 2500 men in New Zealand are diagnosed with the disease, while over one-sixth will ultimately die from their disease [1]. This roughly equates to one in nine men being diagnosed with prostate cancer while 1 in 54 men will die from the disease.

The widespread introduction of PSA testing within Australasia has been responsible not only for the increasing diagnosis of prostate cancer but also for the stage migration on presentation of the disease. Year on year, men are increasingly diagnosed with localized disease while the incidence of more advanced and metastatic disease at presentation has fallen dramatically.

Open radical prostatectomy (ORP) for the treatment of localized prostate cancer was first described by Hugh Hampton Young in
The popularity of the procedure was initially hampered due to high complication rates resulting from intraoperative bleeding, as well as high rates of postoperative urinary incontinence (UI) and erectile dysfunction. However, since its inception, RP has undergone considerable refinement, most notably following the Reiner and Walsh [3] landmark description of the dorsal venous complex and its surgical control in 1979 and the subsequent description of the anatomical location of the pelvic plexus by Walsh and Donker [4]. As a result, RP has become one of the most common treatment options for men with localized prostate cancer both in Australasia and throughout the world.

However, the last 10–15 years has seen a dramatic change in how many surgical operations, not just RPs, are performed. Increasingly men are undergoing minimally invasive surgery with or without the assistance of robotic technology. Advocates of such approaches have argued that minimally invasive surgery may reduce blood loss and postoperative pain compared with open surgery where large incisions are required to gain access, while optic magnification used for minimally invasive surgery may enable better identification of tissue planes allowing for better dissection of target structures such as the pelvic plexus surrounding the prostate. Without a significant evidence base, the hypothesized advantages of minimally invasive surgery have resulted in a dramatic shift in how men undergo RP. Laparoscopic RP (LRP), popularized in Europe in the late 1990s and subsequently adopted in Australia and New Zealand, has had limited uptake due to the technical challenges of the approach. However, robotic-assisted LRP (RALP) using the da Vinci® surgical system (Intuitive Surgical, Sunnyvale, CA, USA) has increasingly become the surgical approach of choice throughout the world including Australasia [5], although the high costs associated with robotic technology continue to limit its availability. Despite this trend in surgical provision, few data exist concerning the efficacy of minimally invasive surgery compared with open surgery for the treatment of localized prostate cancer.

In this special Australasian edition of BJUI, we systematically review the literature from Australasian centres reporting on the perioperative, functional and oncological outcomes after ORP, LRP and RALP for localized prostate cancer to assess to what extent the advantages of minimally invasive radical prostatectomy have been investigated.

MATERIALS AND METHODS

The electronic databases Medline (1 January 1966 to 1 September 2010), Embase (1980–2010), the Health Management Information Consortium and the Cochrane library were searched to identify studies reporting outcome after open and minimally invasive prostate cancer surgery. Studies were sought using the search term ‘radical prostatectomy’. The reference lists of all identified papers were hand searched for other relevant studies and electronic searches were performed using the names of key authors who were known to have published widely in this field. In all, 11 378 articles were retrieved.

Studies were included if they contained data concerning RP on the one hand, be that ORP or minimally invasive RP (RALP/LRP), and prostate cancer on the other. Studies were excluded from the review if they did not contain data pertaining to surgery performed within Australasia. All collaborative studies in which Australian or New Zealand data were combined with those of institutions outside Australasia were excluded. In all, 28 studies met the final inclusion criteria.

Two reviewers assessed the retrieved papers for inclusion and exclusion criteria. The same reviewers extracted data from included papers. Any disagreement in study inclusion or data extraction was resolved by a third reviewer.

Studies were first grouped according to whether they reported on ORP, LRP or RALP. Data were subsequently extracted from each study on author’s name, year of publication, study type, country of study origin, study size and finally mean study follow-up. Data were then extracted on perioperative, functional and oncological outcome.

For perioperative outcome measures, data were extracted from each study on operative duration, estimated blood loss (EBL), blood transfusion requirement, hospital stay and finally adverse events (AEs)/complications.

For functional outcome measures, data were extracted from each study on two functional outcomes, namely urinary continence and erectile function. Where possible, the method by which each functional outcome was assessed was documented.

For oncological outcome measures, data were extracted from each study on two oncological outcomes, namely positive surgical margin (PSM) status and biochemical failure (BCF).

The studies were grouped according to surgical method and then in chronological order by date of publication and are summarized in tabular form in Table 1 [6–33].

RESULTS

Table 1 summarizes the results from studies reporting outcome of ORP, RALP and LRP. In all, 28 Australasian studies were identified in the literature search of which 17 reported on ORP, nine reported on RALP while two reported on LRP. No randomized controlled trials comparing ORP, RALP and LRP were identified. Instead, all publications related to single-centre or multicentred case series, most of which were retrospective in nature.

Four studies were from New Zealand, while the remaining 24 studies were from Australia. In total, data on 8518 ORPs, 1783 RALPs and 80 LRPs are reported. However, serial publications reporting on cumulative ORP and RALP experience were noted to emanate from several high-volume centres. As such, data included in this review represent outcomes from 4065 ORPs and 812 RALPs.

DATA FROM COMPARATIVE STUDIES

Two comparative case series were identified, each of which compared ORP with RALP. The first, by Doumerc et al. [6], compared perioperative outcomes and UI scores for 502 men undergoing ORP with 212 men undergoing RALP in a single-surgeon series. The study specifically addressed learning competence for RALP. The mean operative duration was significantly shorter for ORP at 148 min compared with 192 min (P < 0.001). The mean EBL on the other hand was significantly lower for RALP, although interestingly no difference was identified in transfusion rates. Catheterization time was significantly shorter for RALP at 6.3 days compared with 7.9 days (P = 0.001). The hospital stay was also significantly shorter for RALP at 2.8 days compared with 5.5 days (P < 0.001). Serious AEs (Clavien grade III–V) after ORP and RALP were similar at 1.8% and...
<table>
<thead>
<tr>
<th>Reference</th>
<th>Study type</th>
<th>Cases, N</th>
<th>Follow-up, months</th>
<th>PSM, %</th>
<th>Op. time, min</th>
<th>EBL, mL</th>
<th>LOS, days</th>
<th>AEs, %</th>
<th>Continence, %</th>
<th>Potency rates, %</th>
<th>BCF* rate, %</th>
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<td>1939</td>
<td>32.3</td>
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<td>(predictors of BCF)</td>
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<td>CS</td>
<td>36</td>
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<td>CS</td>
<td>100</td>
<td>13.9</td>
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TABLE 1 Perioperative data, postoperative morbidity, functional outcome and oncological outcome in the Australasian studies reporting outcome following ORP, LAP and RALP.
### TABLE 1 Continued

<table>
<thead>
<tr>
<th>Reference</th>
<th>Study type</th>
<th>Cases, N</th>
<th>Follow-up, months</th>
<th>PSM, %</th>
<th>Op. time, min</th>
<th>EBL, mL</th>
<th>LOS, days</th>
<th>AEs, %</th>
<th>Continence, %</th>
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<th>BCF* rate, %</th>
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<td>Doumerc et al 2010 [6]</td>
<td>CS RALP</td>
<td>212</td>
<td>11.2</td>
<td>21.2</td>
<td>192</td>
<td>&lt;500</td>
<td>2.8</td>
<td>1.8</td>
<td>Cont. EPIC scores reported</td>
<td>■</td>
<td>■</td>
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<tr>
<td></td>
<td>RP</td>
<td>502</td>
<td>17.2</td>
<td>16.7</td>
<td>148</td>
<td>&lt;500 in 98.4%</td>
<td>0.9% BT</td>
<td>5.5</td>
<td>0.2 lb (Dindo)</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Khaira et al 2006 [31]</td>
<td>CS</td>
<td>285</td>
<td>■</td>
<td>17.9</td>
<td>190 vs 205</td>
<td>7/285 BT</td>
<td>3.2</td>
<td>15</td>
<td>13.6 vs 20</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>O’Malley et al 2006 [8]</td>
<td>CS</td>
<td>200 sub-anal (40)</td>
<td>■</td>
<td>15.5</td>
<td>200</td>
<td>0% BT</td>
<td>4.2</td>
<td>3%</td>
<td>■</td>
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<tr>
<td>Murphy et al 2009 [9]</td>
<td>CS</td>
<td>400</td>
<td>22</td>
<td>19.2</td>
<td>186</td>
<td>2.5% BT</td>
<td>3.1</td>
<td>15.75</td>
<td>91.4 (12 m)</td>
<td>62 (12 m)</td>
<td>13.3</td>
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<td>Costello 2005 [32]</td>
<td>CS</td>
<td>122</td>
<td>■</td>
<td>16.3</td>
<td>■</td>
<td>3% BT</td>
<td>2</td>
<td>5/122 BNS</td>
<td>82 (6 m)</td>
<td>■</td>
<td>■</td>
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<tr>
<td>Webb et al 2009 [7]</td>
<td>CS RALP</td>
<td>100</td>
<td>14.3</td>
<td>■</td>
<td>■</td>
<td>525</td>
<td>■</td>
<td>0/100 BNS</td>
<td>■</td>
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<td>ORP</td>
<td>100</td>
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<td>■</td>
<td>■</td>
<td>565</td>
<td>■</td>
<td>9/100 BNS</td>
<td>■</td>
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<td>■</td>
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<tr>
<td>Van Appledorn et al 2006 [22]</td>
<td>CS</td>
<td>150</td>
<td>17.1</td>
<td>191 (last 10)</td>
<td>4/150 BT</td>
<td>3.4</td>
<td>3%</td>
<td>1 RI</td>
<td>■</td>
<td>■</td>
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<tr>
<td>Watts et al 2009 [33]</td>
<td>CS LRP</td>
<td>214</td>
<td>■</td>
<td>■</td>
<td>195</td>
<td>■</td>
<td>3</td>
<td>1/30 RI</td>
<td>■</td>
<td>■</td>
<td>■</td>
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<tr>
<td>Wilson et al 2004 [15]</td>
<td>CS</td>
<td>30</td>
<td>6 minimum</td>
<td>23</td>
<td>328</td>
<td>10% BT</td>
<td>2.75</td>
<td>1/30 AL</td>
<td>■</td>
<td>■</td>
<td>4.5</td>
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<tr>
<td>Hellawell and Moon 2008 [16]</td>
<td>CS LRP</td>
<td>50</td>
<td>6</td>
<td>8</td>
<td>225</td>
<td>400 6% BT</td>
<td>3</td>
<td>■</td>
<td>■</td>
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</table>

CS, case series; CZ, central zone; PZ, peripheral zone; TZ, transitional zone; EPIC, Expanded Prostate Cancer Index Composite; CG, Clavien-Dindo Grade; BT, blood transfusion; LOS, length of stay; BNS(S), bladder neck (stenosis); CR, clot retention; RI, rectal injury; PH, pelvic haematoma; GIb, gastro-intestinal bleed; AL, anastomotic leak; UF, urinary function; UB, urinary bother; SF, sexual function; SB, sexual bother. *BCF defined as a PSA level of ≥0.2 ng/mL.
The main objective of that comparative study was to assess the learning curve for RALP. Analysis of RALP outcomes suggested that although overall continence and PSM rates were inferior for RALP compared with ORP, as surgeon experience of RALP increased, both continence and PSM rates became equivalent to ORP. Thresholds for equivalence depended on the outcome of interest with continence rates being similar after 200 cases and PSM rates being similar after 120 cases (60 cases for T3).

The second comparative study, by Webb et al. [7], specifically addressed the issue of bladder neck contracture after RALP and ORP. In their study, a single surgeon’s case series of 200 consecutive men undergoing prostatectomy (100 ORP and 100 RALP), bladder neck contractures were absent after RALP while 9% of men developed a contracture after ORP. Interestingly, the authors identified the practice of racquet-handle repair and mucosal eversion of the bladder neck in the ORP group as the likely cause of a higher bladder neck contracture rate in this group.

Although not specifically designed as a comparative study, a further paper reported PSM rates between a single-surgeon series of ORP and RALP. O’Malley et al. [8] reported the initial experience of RALP in Australia in which the outcomes of 200 cases were reported, and also reported a comparison between the PSM rates of the first 102 RALPs in this series and the previous 102 ORPs performed by the same surgeon. In an unmatched analysis, the overall PSM rates were 26.4% for ORP and 13.7% for RALP (P = 0.05).

All other studies identified in this review were case series reporting on each surgical technique in isolation, making comparison difficult.

DATA CONCERNING PERIOPERATIVE VARIABLES AND POSTOPERATIVE MORBIDITY

Disappointingly, few perioperative data and postoperative morbidity data were available for ORP as most of the studies reporting on ORP concern oncological efficacy. No specific perioperative details were available for any of the ORP series apart from the Doumerc et al. [6] comparative data detailed earlier. Perioperative data for RALP and LRP were more abundant.

For the nine included reports of RALP (Table 1), the total mean operative time varied between 148 and 251 min. For the two papers reporting LRP data, the total mean operative time trended towards a longer time at 225–328 min. Blood transfusion rates also appeared lower for RALP then for LRP, with 1.7% on average requiring transfusion (range 0.9–3.0%) compared with 8% for LRP. The mean hospital stay after RALP appeared comparable with LRP at <3 days, at a mean (range) of 2.85 (1.1–5.5) days for RALP and 2.87 (2.75–3.0) days for LRP.

However, all these data are greatly limited by the lack of randomized or well-designed comparative studies, and also by the few cases in the LRP series.

Overall, reporting of AEs was incomplete for all approaches, again most notably for ORP. Only two studies reported AEs according to the validated Clavien complication scoring system [34]. One of these is the comparative study by Doumerc et al. [6] discussed previously. The other from Murphy et al. [9], reporting on outcome of 400 RALPs, identified that <16% of men developed an AE after RALP, with 5% having a grade III injury with no grade IV–V injuries. This figure includes five men (1.25%) who had a rectal injury. Of the two non-comparative case series reporting on LRP, rectal injury was identified in a similar proportion (1 of 80 cases, 1.25%).

DATA CONCERNING FUNCTIONAL OUTCOME

Few data were available on functional outcome for all three approaches. A further confounding issue is that different studies used different assessment methods to report both continence and erectile function, thus making it difficult to compare outcomes of the different surgical approaches across different studies due to their dissimilar study design. Caution must therefore be exercised in interpreting these data.

According to the five studies identified that reported urinary function after ORP [10–14], 4–9% of men had severe or daily UI. For other urinary complications, Masters and Rice [14] reported that 20% of their 125 ORP patients developed anastomotic stricture requiring dilatation. Four studies reported on UI after RALP, the rates of 8.6–32% depending upon severity. Anastomotic stricture rates after RALP were 0–3.75%. At 6 months after LRP, 17–18% of patients required pads for UI in the two studies reported [15,16].

Data on erectile function were even sparser than for urinary continence and similarly suffered from variations in the definitions used to assess erectile function after RP. Two studies reported erectile function after ORP. Newton et al. [10] reported that 14% of men had good erections after ORP while the other study reported mean sexual function and sexual bother scores of 33.6 and 40.6 respectively (University of California Los Angeles Prostate Cancer Index, UCLA-PCI [35]), suggesting relatively marked impairment of sexual function [10]. Similar to ORP, there were two studies that reported on erectile function after RALP with good function being reported in 12% [17] and 62% [9], respectively. One of the two published studies reported erectile function after LRP. In that study, 37% of men were identified to be potent at 3 months after LRP [16].

DATA CONCERNING ONCOLOGICAL OUTCOME

The two most commonly reported oncological outcomes after RP were BCF and PSM status. There is insufficient follow-up for overall and disease-specific mortality to be evaluated.

Nine studies reported on BCF after ORP with rates varying between 13.8% (mean follow-up 32.3 months [18]) and 45% (mean follow-up 108 months [19]).
Two studies reported BCF after RALP with significantly shorter follow-up than for the ORP series included in this review. Duthie et al. [17] reported 5% of patients having BCF at a mean of 13.9 months after RALP and Murphy et al. [9] reported 13.3% of patients having BCF at a mean of 22 months after RALP. BCF after LRP was reported for 4.5% and 6% of patients at a mean follow-up of 6 months [15,16]. However, these rates need to be put in the context of varying and limited follow-up for RALP and LRP compared with ORP.

PSM status represents a surrogate marker for surgical quality in organ-confined disease and is a risk factor for subsequent BCF. There were nine studies that reported on surgical margin status after ORP with overall PSM rates varying from 12% [20] to 46.7% [21]. This compared with overall PSM rates of between 15.5% [22] and 21.2% [6] for RALP and between 8% [16] and 23% [19] for LRP. However, clearly PSM status may be affected by a number of variables including tumour characteristics, nerve-sparing approach and surgeon experience, and therefore the technique alone may not be responsible for differences in PSM.

DISCUSSION

Issues surrounding ORP vs minimally invasive RP have provoked much debate globally, including within Australasia. Despite the lack of high-quality evidence to justify its role, RALP has rapidly become the preferred approach for RP in the USA and is increasing in popularity in this and many other regions. In this review, we evaluated the evidence from within Australasia regarding ORP and minimally invasive RP and noted that no high-quality data exist to generate any meaningful conclusions on the role of minimally invasive approaches. This lack of high-quality data is not limited to Australia and much comment has been made in recent times about the lack of an evidence base globally to justify the increasing popularity of RALP in particular [36,37]. Comment has also been made about the low quality of evidence to evaluate, in particular, the functional outcomes after ORP [38]. However, it is clear that RALP is increasing in popularity and availability in Australia and New Zealand with 12 da Vinci® surgical systems installed across these two countries at the end of 2010. While LRP still remains popular in Europe, it has almost no proponents in the USA and uptake has clearly been limited elsewhere as RALP has become more widely available. In addition, concerns about the very long learning curve for LRP have stifled the enthusiasm of many [39]. Within Australasia, only 80 cases of LRP have been reported and we note that the senior authors of both of these series have now embraced RALP.

Only two Australasian comparative studies evaluating ORP and RALP were identified. The mean EBL, catheterization time and hospital stay were shorter after RALP while the rate of bladder neck stricture was significantly higher after ORP. However, even within this comparison it should be noted that the ORP series are not contemporary and may not reflect best practice in ORP within Australasia today. Considerable refinements to ORP technique and care pathways have been adopted in the past few years and further data regarding contemporary ORP outcomes would be most welcome.

Incorporation of patient outcomes achieved by surgeons still within their learning curve resulted in a trend towards higher PSM rates and lower continence scores after RALP, although equivalence was achieved once the surgeons’ learning curve was overcome. Limited follow-up and lack of data concerning erectile function status made comparison of BCF and potency impossible.

COMPARISON WITH OTHER STUDIES

To date there have been 37 studies globally that have compared the outcome of minimally invasive RP (LRP or RALP) with ORP and many more studies reporting the outcome of single-centre experiences for ORP and minimally invasive RP. In general, the studies that are available are of poor quality with no level 1 evidence. Most studies have reported results similar to those in this review, namely that perioperative outcomes appear to favour the minimally invasive approach while the data concerning functional and oncological outcome are not sufficiently mature to comment upon.

Similar to the one comparative study identified in this review reporting operative procedure time, reported operative procedure times for RALP tend to be longer than for ORP. Cumulative analysis from a recent review [40] found that operative time was on average 72 min longer for RALP than ORP, a figure not greatly dissimilar to the figure of 44 min reported by Doumerc et al. [6] in their comparison. Furthermore, although operative time does vary considerably in publications on RALP, most studies reporting single-centre experiences of RALP report a mean operative time around the mean time identified in this review of 180 min. Coelho et al. [41], reviewing over 8000 reported cases of RALP, noted a weighted mean operative time of 166 min. In contrast, most studies reporting on ORP report an operative time of 130–160 min.

We also found that EBL and hospital stay were lower for RALP than ORP. Again this finding is in agreement with most studies that have reported on this topic. For example, Farnham et al. [42] reporting on 103 ORPs and 176 RALPs found that mean EBL was higher in the ORP group (664 mL) compared with the RALP group (191 mL), while Ahlering et al. [43], reporting on 60 ORPs and 60 RALPs, found that hospital stay fell from 2 days to 1 day.

Unfortunately, only two of the 11 studies included in this review collected data on AEs after surgery according to a specified classification system such as the Clavien system. One of these was a comparative study that found no difference in complication rates between ORP and RALP [6]. This finding is again consistent with most studies reporting on this topic, although some authors have reported lower complication rates after minimally invasive RP [44]. However, it should be noted that few studies report complications according to a standardized classification system, such as the Clavien system, and thus comparison between ORP and minimally invasive techniques must be interpreted with caution. This is especially pertinent as most studies reporting on this issue are retrospective in nature.

One of the two comparative studies identified in this review suggested that anastomotic strictures were less common after RALP than after ORP. The authors clearly identified that this was due to differences in their technique and therefore an adjustment of their ORP technique may have yielded lower stricture rates in that group. Elsewhere, data on this topic are rather conflicting. A recent review suggested that, on average, anastomotic strictures were indeed nearly three times less frequent after LRP than ORP at 6% vs 2%, although reported figures vary dramatically [40]. However, when analysis was limited to
prospective studies, the lower stricture rate seen for LRP was not evident. Furthermore, no difference in stricture rate has been described between LRP and RALP. It should also be noted that non-randomized comparative series from elsewhere have failed to establish any superiority of RALP over ORP when experienced ORP surgeons are involved [45].

FUNCTIONAL OUTCOME

Australasian data concerning functional outcome after ORP and minimally invasive RP were sparse and were limited by lack of standardization of instruments used to measure these outcomes. This problem is inherent in RP publications globally.

In the present review, those studies that did report rates of continence reported values of ≈90% for both ORP and RALP, a figure that is similar to publications from elsewhere [40]. Indeed, the vast majority of studies comparing ORP with RALP have suggested that rates of continence are similar between the two techniques. However, of interest, Tewari et al. [46] have suggested that continence may return more quickly after RALP, although no Australasian data were available from this review to substantiate this finding.

Data from the present Australasian review concerning erectile function were even sparser than for urinary continence with only two ORP and three minimally invasive RP studies reporting erectile function status after surgery; thus no conclusions could be made. This lack of data is mirrored globally and remains an area of controversy. Reports of potency rates after RALP in excess of 90% [47] have been met with some bewilderment and have led to greatly heightened patient expectations and the possibility of disappointment subsequently [48]. This has led to calls for more rigorous and standardized assessment of erectile function before and after RP, so that results can be more carefully evaluated and patients can be better informed [49]. Reported erectile function recovery after RALP in Australasia is 62% [9] and 12% [17] in the two series that have reported on this outcome to date. Contemporary data on erectile function after ORP in Australasia is lacking, although data will become available as part of a Prostate Cancer Clinical Registry that is currently collecting data within Victoria.

ONCOLOGICAL OUTCOME

To date no comparative data are available comparing BCF after ORP and minimally invasive RP, and in view of the vastly different follow-up durations identified in this review between ORP and RALP series it is impossible to make conclusions on this topic from Australasian data. Clearly, with the longer follow-up in the Australasian ORP series compared with the RALP and LRP series, one would also expect to see a higher BCF rate. It should also be considered that the ORP series reported here have a mean presenting PSA level of ≈9 ng/mL, which is significantly higher than large series from the USA that typically have a presenting PSA level of ≈6 ng/mL. Stage migration has had a more profound effect in the USA where men present with earlier disease than in Australasia, although this is now changing with more widespread use of PSA testing.

We did identify some comparative studies evaluating PSM status. One study that evaluated PSM status suggested that PSM status was similar between ORP and minimally invasive RP, although sub-analysis suggested more PSMs occurred after RALP for T3 disease [6]. However, PSM rates after RALP did become comparable with ORP once the learning curve for RALP had been overcome (≈70 cases). Most studies suggest that ORP is associated with higher PSM rates overall but the learning curve for RALP should certainly not be underestimated. For example, Tewari et al. [46], reporting on 100 ORPs and 200 RALPs, suggested PSM rates fell from 23% to 6%. Smith et al. [50], reporting on 200 ORPs and 200 RALPs, found a similar trend but to less extent with PSM rates falling from 35.7% to 15%. A challenge within Australasia and indeed other regions outside the USA is that few surgeons will reach this volume within a short period and therefore it may take many years to overcome the learning curve.

LEARNING CURVES

The present review identified one study that evaluated the learning curve for RALP, comparing outcomes achieved during the minimally invasive learning curve with those of ORP. The study suggested that, for equivalence in rates of continence and PSMs to be achieved, between 170 and 200 cases need to have been performed by an individual surgeon [6]. These figures are comparable with those recently reported in a large multicentre study reporting on 8544 consecutive patients undergoing LRP in Europe and the USA, which found that PSM rates only began to plateau at between 200 and 250 cases [51]. Regardless of surgical approach, it is clear that surgeon experience is the key factor in determining good outcomes for patients undergoing RP and therefore this procedure should be delivered by fellowship-trained high-volume surgeons.

METHODOLOGICAL LIMITATIONS OF THE REVIEW

The present review, like all reviews, suffers from the limitation of publication bias. For example, advocates of a particular technique may not publish outcomes that are unfavourable. This is especially a problem given that all of the studies in this review were case series, most of which were retrospective in nature documenting a single surgeon’s or institution’s surgical experience.

IMPLICATIONS OF THE REVIEW

The first implication of the present review is that, despite the lack of data available from Australasia comparing ORP with minimally invasive RP, the data that do exist suggest that the dramatic shift towards the minimally invasive approach may be justified given that the perioperative outcomes achievable appear favourable compared with open surgery. The caveat to this statement, which also represents the second implication of the present review, is that high-quality prospective comparative data are urgently required to verify, not only that perioperative outcomes are indeed better after minimally invasive surgery, but also that the longer term functional and oncological outcomes achievable by minimally invasive surgery are at least equivalent to ORP, especially given that these outcomes are of greater overall clinical importance. A further limitation as mentioned previously is that the existing reports of ORP from within Australasia are somewhat historic and reports of contemporary outcomes would be welcome. It is pleasing to note that a randomized controlled trial of ORP vs RALP is currently under way at Royal Brisbane Hospital and that a non-randomized comparative study of ORP, LRP and RALP is at present under way in Melbourne, and the results of these studies...
will help inform us of the role of minimally invasive RP in the future.

CONCLUSIONS

Few comparative data are available from Australasia concerning ORP and minimally invasive RP. While perioperative outcomes appear to favour minimally invasive approaches, further comparative assessment of functional and long-term oncological efficacy for the different surgical approaches is certainly required before the role of minimally invasive RP can be defined in this region.

CONFLICT OF INTEREST

None declared.

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Abbreviations [O](L)RP, (open) (laparoscopic) radical prostatectomy; UI, urinary incontinence; RALP, robotic-assisted LP; EBL, estimated blood loss; AE, adverse event; PSM, positive surgical margin; BCF, biochemical failure.