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A comparison of operative and margin outcomes from surgeon learning curves in robot assisted radical prostatectomy in a changing referral practice

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ABSTRACT

INTRODUCTION The aim of this study was to explore the impact of increasing proportions of high risk referrals on surgical margin outcomes of a surgeon's learning curve in robotic prostatectomy.

METHODS All patients in this study underwent robot assisted radical prostatectomy (RARP) performed by three different consultant urological surgeons. Data collected included preoperative clinical stage, Gleason score and prostate specific antigen levels, which were used to risk stratify patients according to National Institute for Health and Care Excellence criteria. Oncological clearance was assessed by overall and stage specific positive margin status. Comparisons were made between each surgeon for the first and second 50 consecutive cases.

RESULTS For the three surgeons, there was a progressive increase in the proportion of high risk cases referred accompanied by a corresponding decline in low risk disease ($p<0.001$). Postoperative pathology also showed an upward trend in pT3 cases across the three eras. There was no statistical difference in overall positive margin rates between the surgeons. The overall rates were 12%, 20% and 23% for the first 50 cases, and 32%, 36% and 21% for the second 50 cases for the three surgeons respectively.

CONCLUSIONS Our series demonstrates an upward trend in the risk profile of men referred for robotic prostatectomy over a nine-year period. Despite this, there was minimal impact on pathological and surgical outcomes among our surgeons, who were at the initial stages of their RARP learning curve. Our results suggest that there is no requirement for an active case selection bias against patients with high risk disease for surgeons newly embarking on their RARP learning experience.

KEYWORDS
Learning curve – Robot assisted radical prostatectomy – Early oncological outcomes

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Prostate cancer is the most common malignancy in men and remains a major cause of cancer related mortality.[1,2] There is currently no official prostate screening programme in the UK. However, studies have shown that the number of cases diagnosed yearly in the UK is rising and this looks set to continue along a similar trend for many years to come.[3]

National Institute for Health and Care Excellence (NICE) risk stratification groups for localised prostate cancer are defined as low risk (prostate specific antigen [PSA] <10ng/ml, Gleason score ≤6 or cT1–T2a), intermediate risk (10–20ng/ml, Gleason 7 or cT2b) or high risk (>20ng/ml, Gleason 8–10 or ≥cT2c).[4] A study from 2013 looking at a ten-year trend in prostate cancer risk profile identified significant increasing incidences of intermediate and high risk disease in the UK.[1] As a result, there is an increase in the presentation of men with prostate cancer requiring active treatment.

To date, the benefits of surgery have been shown mainly in men with higher risk disease.[5] Over the last decade, there has been a clear shift in the management of prostate cancer in the UK, with increasing use of surgery for younger patients with high risk disease. This trend has also been observed in our unit.[6–8] In contrast, the proportion of men with low risk disease having surgery appears to be on the decline with the concurrent increase in the use of active surveillance as a treatment modality.[9]

Traditionally, men with high risk prostate cancer were not thought to be ideal candidates for training surgeons at the beginning of their robot assisted radical prostatectomy (RARP) learning curve owing to the increased chances of a positive surgical margin (PSM). This is because men with higher risk prostate cancer have a higher burden of disease and worse oncological outcomes from the outset.[10–12] As a

result of changes in the surgical management of prostate cancer, urologists are now increasingly operating on patients with higher risk disease.[8]

This study examined the learning curves and surgical outcomes of three surgeons who started RARP at a single centre over an eight-year period. In particular, the potential impact was explored of changing referral practices on the intraoperative and margin outcomes of patients undergoing robotic prostatectomy at this unit.

Methods

All patients in this study underwent RARP between 2005 and 2014 at Addenbrooke's Hospital with one of three different consultant urological surgeons operating. (Surgeon A commenced in 2005, surgeon B in 2008 and surgeon C [VJG] in 2010.) All patients were recruited into an ethically approved study for prospective data collection.

Preoperative data collected from the prospective database comprised baseline demographics, Gleason score, baseline PSA and tumour stage (cT2, cT3). Operative outcomes focused on PSMs, operating time (excluding robot setup/docking time) and intraoperative blood loss. All pathological outcomes (pT2, pT3a, pT3b) were reviewed in a specialist multidisciplinary team meeting. Tumour volume (as a percentage of the whole resected prostate) was determined on final pathology. All surgeons underwent a modular three-day training programme and received mentor-led training at the console.[13] Each patient's risk profile was stratified based on the NICE risk classification,[4] and the respective surgeons' first 50 and second 50 cases were compared for intraoperative and oncological outcomes. Statistical analysis was conducted using SPSS® version 16 (SPSS, Chicago, IL, US) with a p-value of <0.05 considered statistically significant.

Results

The first 100 cases for each of the 3 surgeons were reviewed. The 300 patients had a median age of 61.5 years (range: 39–74 years) and a median preoperative PSA of 7ng/ml (range: 0.5–85ng/ml). The median preoperative Gleason score was 6 for surgeons A and B while for surgeon C, it was 7. The mean prostate volumes were 53g and 51g (surgeon A), 56g and 55g (surgeon B), and 52g and 51g (surgeon C) for the first and last 50 cases respectively (Table 1).

There was a progressive increase in the proportion of preoperative high risk cases with a corresponding decline in low risk disease in the three surgeons' practice (Fig 1). Low risk cases represented 55%, 33% and 25% of the patients for surgeons A, B and C respectively. In contrast, high risk cases

Table 1 Preoperative, intraoperative and postoperative outcomes for all cases

	Surgeon A		Surgeon B		Surgeon C	
	Cases 1–50	**Cases 51–100**	**Cases 1–50**	**Cases 51–100**	**Cases 1–50**	**Cases 51–100**
Preoperative outcomes						
Mean age (range)	61.5 years (39–74 years)					
Median PSA (range)	7ng/ml (0.5–8.5ng/ml)					
Median preoperative Gleason score (range)	6 (4–9)		6 (6–8)		7 (4–9)	
Intraoperative outcomes						
Median blood loss (range)	288ml (30–2,250ml)	225ml (30–1,200ml)	250ml (30–900ml)	250ml (20–1,250ml)	300ml (100–700ml)	200ml (50–800ml)
Median operating time (range)	185 min (127–420 min)	180 min (77–370 min)	237 min (151–345 min)	201 min (132–333 min)	270 min (192–327 min)	220 min (180–300 min)
Postoperative outcomes						
Mean prostate volume (range)	53g (18–125g)	51g (27–103g)	56g (35–118g)	55g (24–119g)	52g (26–92g)	51g (27–78g)
Mean tumour volume (range)*	9% (0–40%)	15% (0.5–50%)	8% (0.5–40%)	13% (1–70%)	22% (1–70%)	17% (1–70%)
Postoperative pathological stage						
pT2	37 (74%)	30 (60%)	30 (60%)	25 (50%)	23 (46%)	23 (46%)
pT3a	11 (22%)	19 (38%)	17 (34%)	21 (42%)	24 (48%)	22 (44%)
pT3b	1 (2%)	0 (0%)	2 (4%)	4 (8%)	3 (6%)	5 (10%)

PSA = prostate specific antigen
*as a percentage of prostate volume

constituted 10%, 15% and 24% of each surgeon's cohort (p=0.001). This trend is reinforced when looking at the preoperative clinical staging for each surgeon's first 50 cases; there was evidence of a progressive increase in the proportion of cT3 patients over the three learning curve periods (p=0.002) (Fig 2).

Intraoperative outcomes

Blood loss and operating time reduced progressively with increasing experience for all surgeons regardless of when their training commenced. When comparing individual surgeons' outcomes, a general improvement in intraoperative outcomes (ie reduction in blood loss) can be seen for surgeons A and C between the first and last 50 cases. For surgeon B, however, blood loss remained the same throughout (Table 1). A reduction in console operating time was observed for all surgeons between the first and last 50 patients. Surgeon A's median console time improved by 5 minutes to 180 minutes, surgeon B's improved by 27 minutes to 210 minutes and surgeon C's improved by 50 minutes to 220 minutes (Table 1).

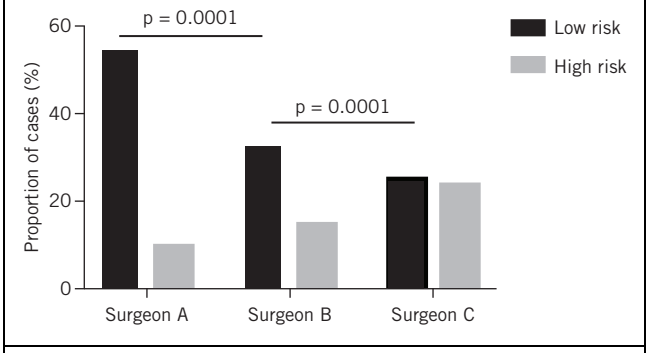

Figure 1 Proportions of high and low risk cases for the three surgeons

Surgical margin outcomes

There was a progressive increase in the proportion of high risk pT3a cases over the three learning curve periods (surgeon A: 22%, surgeon B: 34%, surgeon C: 48%). A similar trend was observed when comparing the second 50 cases for each of the surgeons. Final tumour volumes were higher for surgeon C than for surgeons A and B, who had commenced their learning before 2010 (Fig 3).

The pT2 PSM rates were 10%, 13% and 12% for the first 50 cases for surgeons A, B and C respectively (p=0.79), and 16%, 12% and 8% for the second 50 cases (p=0.70). The corresponding rates for pT3a tumours were 9%, 35% and 36% for the first 50 cases (p=0.22), and 53%, 57% and 30% for the second 50 cases (p=0.21). There was also no statistical difference in overall PSM rates between the surgeons. The overall rates were 12%, 20% and 23% for the first 50 cases, and 32%, 36% and 21% for the second 50 cases respectively (Fig 4).

Discussion

This study reports on the first 100 RARP cases performed by each of three surgeons in a single UK institution but at different stages of the evolution of a tertiary referral practice. Our data demonstrate an increase in the proportion of preoperative high risk patients undergoing RARP and an associated fall in the number of patients referred with low risk prostate cancer. Concomitantly, an overall higher proportion was noted of pT3 disease at final pathology compared with other series, particularly as the series evolved with time.[9]

Our findings further confirm a previous study that shows that there have been significant shifts in the management of non-metastatic prostate cancer in the last decade with low risk disease increasingly being managed conservatively and high risk disease treated surgically in the UK.[7] The future of RARP training will therefore need to be geared towards familiarising surgeons with exposure to higher risk cases at an earlier stage of their robotic training. Our study confirms

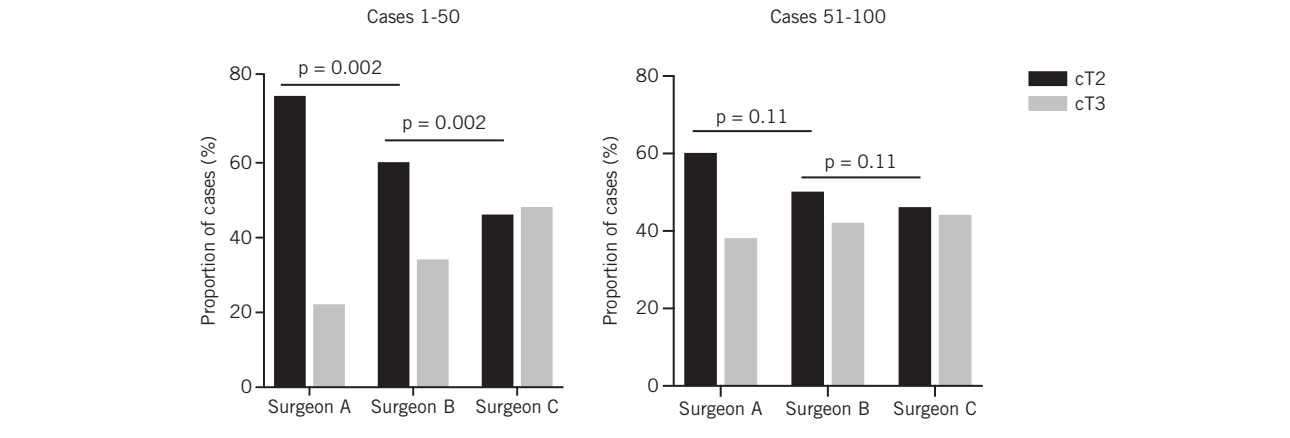

Figure 2 Proportions of preoperative T2 and T3 cases for the three surgeons

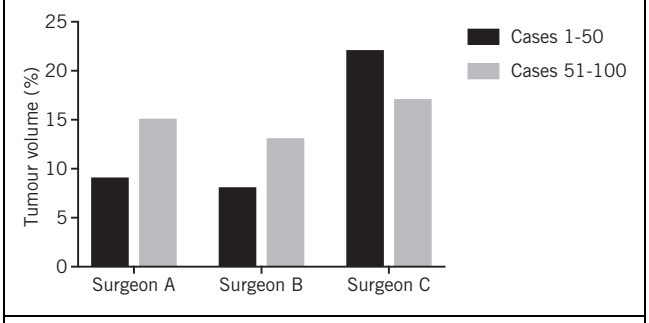

Figure 3 Mean tumour volumes (as a percentage of the prostate) for the three surgeons

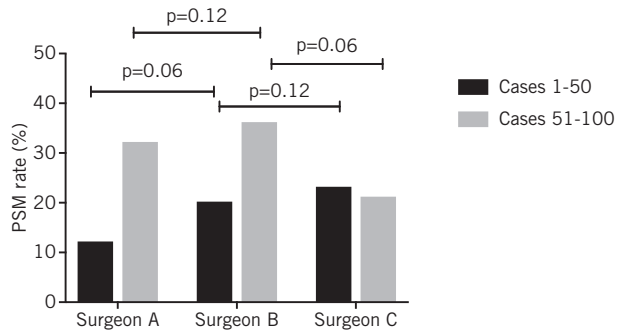

Figure 4 Positive surgical margin (PSM) rates for the three surgeons

that this can be achieved safely and does not disadvantage patients in terms of tumour clearance or PSM rates.

With respect to intraoperative outcomes, the mean blood loss across the three surgeons was 252ml and the mean operating time was 215 minutes. These results are comparable with the results obtained in other published series.[14,15] Consequently, structured training programmes and mentorship remain paramount in maintaining high surgical standards.[16] This has particular relevance for men having radical prostatectomy in the context of minimising PSM rates.

Study limitations

There are certain limitations to this study. This was a single centre series that focused on the first 100 cases of RARP only. To our knowledge, however, it is the only UK study to date that has explored the impact of a changing referral practice on learning curve outcomes. The learning curves of surgeons in our institution were not compared against those in other UK centres so our results may not be generalisable across the nation. Furthermore, postoperative continence rates were not specifically examined in this study although these data have been presented previously in a separate paper by our group.[12]

Conclusions

This study shows that despite an upward trend in high risk referrals for RARP over time, there have been no adverse margin outcomes from surgeons beginning their learning experience at different times. Larger prospective case series with added postoperative functional outcomes data will further inform these findings. Nevertheless, our study suggests that there is no need for an active case selection bias against patients with high risk disease for surgeons newly embarking on their RARP learning experience. In our opinion, this provides strong reassurance to centres training robotic surgeons as well as evidence to allay patient concerns when their operations are being undertaken by a novice robotic surgeon.

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