Radical Prostatectomy Practice in England

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Purpose: As there is paucity of data on radical prostatectomy (RP) as a primary treatment for patients with localized prostate cancer, we analyzed the trends in the RP practice in England.

Materials and Methods: This study was carried out on 14 300 patients who underwent RP for carcinoma of the prostate. Database was prepared from hospital episode statistics of the Department of Health in England. National trends in RP practice were summarized as well as volume outcome analysis.

Results: Annual number of RPs exponentially increased from 972 (1998 to 1999) to 3092 (2004 to 2005). Laparoscopic RPs increased from 2 to 257 over the study period. Median waiting duration increased by more than 10 days (13 days). Significant decrease in median length of hospital stay from 8 (range, 7 to 10) days to 6 (range, 5 to 8) days was observed ($P < .001$). More than 90% mortality was seen in patients of ≥ 60 years of age. Significant inverse correlation was found between the hospital volume (Odds Ratio: 0.40) and in-hospital mortality rate following RP. High volume surgeons (≥16) and high volume hospitals (≥26) had significantly lower mortality (Odds Ratio: 0.32) and shorter in-hospital stay in comparison to low volume surgeons and hospitals.

Conclusion: There is an exponential increase in the number of RPs with an increasing trend towards laparoscopic RP in England. This study showed a significant inverse correlation between provider volume (hospital and surgeon) and outcome (in-hospital mortality and hospital stay) for RP in England; thus, supporting the recommendations for centralization of care for complex radical procedures, including RP.

Keywords: prostatic neoplasms, prostatectomy, laparoscopy, treatment outcome, England

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INTRODUCTION

Prostate cancer is the most frequently diagnosed cancer in men in England.[1] With increasing patients' awareness and widespread prostate-specific antigen testing, more than 650 000 men worldwide and approximately 26 000 men in England are diagnosed with prostate cancer every year. Each year, an estimated 221 000 deaths worldwide occur from the prostate cancer, with over 8000 of such deaths being recorded annually within the United Kingdom.[2]

Radical prostatectomy (RP) is widely used as a primary treatment in patients with localized prostate cancer.[3] Due to improvements in anesthesia, peri-operative care, and surgical technique, RP is now associated with lower morbidity than early years.[4] With wide array of new treatment options for the prostate cancer, RP can only remain a preferred treatment modality if it is associated with low morbidity, mortality, and short hospital stay. As there is paucity of data on RP trends in

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England, we addressed the temporal changes in the RP practice in England over 7 years. This study describes the changing trends in patients' demographics, surgical activity, and outcomes (mortality rate and length of hospital stay) for RP.

MATERIALS AND METHODS

A total of 14 300 patients who underwent RP for carcinoma of the prostate by 592 surgeons at 191 hospitals between April 1998 and April 2005 were included in this study. Database was prepared from Hospital Episode Statistics (HES) of Department of Health in England.

National administrative databases have been used increasingly in the USA (Medicare) and Europe (Dutch National Medical Register) to investigate the quality of surgical care.[5,6] Hospital Episode Statistics is the national database of all the patients admitted to National Health Service (NHS) hospitals in England. It has evolved over the years following its establishment in 1989 and is the data source for a wide range of healthcare analysis for the NHS, government, and many other organizations and individuals.[7] Hospital Episode Statistics also forms an important tool for medical research, assessment of performance, and policy development.[8-12]

Diagnostic coding is recorded based on the International Classification of Diseases, 10th revision (ICD-10) criteria and procedure coding is recorded according to the Office of Population, Census and Surveys – Classification of Surgical Operations and Procedures, 4th revision (OPCS4) criteria.[13,14]

At the outset, database was filtered for malignant neoplasm of the prostate by ICD-10 code C61-X in seven diagnostic fields and then OPCS4 codes, indicating total excision of the prostate along with the capsule (M61-1), retropubic prostatectomy (M61-2), perineal prostatectomy (M61-4), RP other specified (M61-8), and RP unspecified (M61-9) in four operative fields. Furthermore, laparoscopic procedures were identified by procedure codes Y50X and Y71X in four operative fields.

Patients' outcomes were analyzed in various age groups. The major outcome variables of this study were mortality rate and length of hospital stay. Patients' characteristics and national trends for RP over the 7-year study period were also assessed.

Each hospital and surgeon has a unique identification code in the HES database. Using these codes, we analyzed the volume outcome relationship for hospital and surgeon volume in England. Annual hospital and surgeon volume thresholds were determined by dividing the patients into two equal-sized groups of high and low volume, based on the median volume (50th percentile), ie, 26 and 16 for hospital and surgical caseload, respectively.

Statistical Analysis

Statistical analysis was performed using SPSS (Statistical Package for the Social Science, version 13.0, SPSS Inc, Chicago, Illinois, USA) and NCSS-Pass (Number Cruncher Statistical System and Power Analysis and Sample Size (Kaysville, Utah, USA, 2004) softwares. One way ANOVA, Chi-square, and Kruskal-Wallis tests were used for univariate analysis if appropriate. Multiple logistic regressions were used to get the risk-adjusted multivariate analysis for both in-hospital mortality and length of hospital stay. Age, waiting time, admission method (emergency or elective), annual surgeon volume, and annual hospital volume were the independent variables used for the risk adjustment. All *P* values were two-sided and *P* values less than .05 were considered statistically significant. Independent variables with *P* values less than .1 in the univariate analysis were included in the multivariate analysis. The multivariate models were tested for goodness of fit using the Hosmer-Lemeshow test.

RESULTS

The mean age (± SD) of the patients was 62.7 (± 6.1) years. A total of 33 in-hospital deaths were reported, giving an overall mortality rate of 0.23%. The median waiting duration (date of decision to operate to date of admission for operation) and median length of hospital stay for patients having RP were 39 days and 7 days, respectively.

National Trends

The number of RPs has increased from 972 to 3092 over the study period. Proportionately, laparoscopic RP has increased from 2 (1998) to 257 (2004) (Figure 1). Patients' characteristics over the study period are described in Table 1. The mean age of the patients has decreased significantly over the same period ($P = .001$). There was an increase of 13 days in the median waiting duration ($P < .001$). In-hospital mortality rate was very low with significant reduction over the study period ($P = .029$). Median length of hospital stay has decreased from 8 days to 6 days.

The number of hospitals performing RP has been nearly constant over the study period and in contrast, number of surgeons performing RP has increased from 194 to 234 (Figure 2). The median hospital volume has increased by 2.6 times ($P < .001$) (Figure 3) and similarly median surgeon volume has increased significantly from 8 to 20 ($P < .001$) over the 7 years (Figure 4).

Patients' age had a significant impact on clinical outcomes and waiting time (Table 2). Median

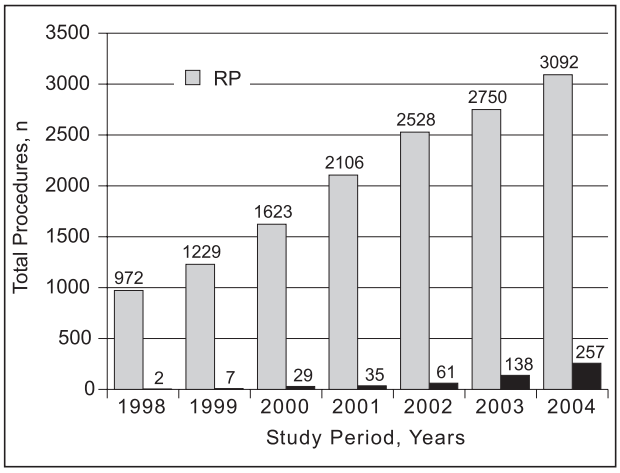

Figure 1. National trends of radical prostatectomy (RP and LRP) in England.

Figure 2. Trends for total number of surgeons and hospitals performing radical prostatectomy in England.

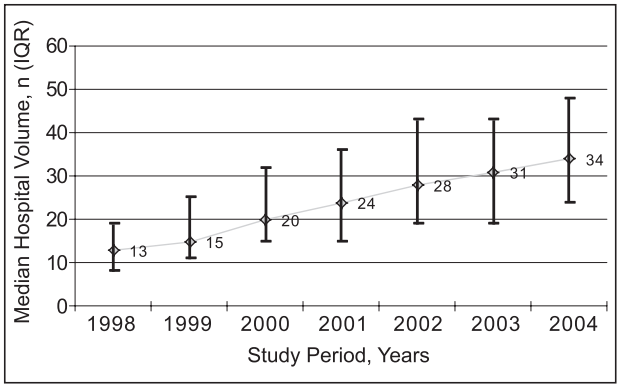

Figure 3. Error bar representing the annual hospital volume over the study period.

Table 1. Patients' characteristics for radical prostatectomy over 7-year study period

Variable	Year							Test (*P*)
	1998	1999	2000	2001	2002	2003	2004	
Mean Age (± SD), years	63.3 (6.4)	62.8 (6.0)	62.7 (6.1)	62.7 (5.9)	62.4 (6.1)	62.5 (6.0)	62.6 (5.9)	ANOVA (.001)
Median (IQR) Waiting time, days	32 (19 to 50)	34 (21 to 50)	39 (21 to 57)	38 (22 to 57)	40 (25 to 59)	40 (25 to 61)	45 (27 to 69)	Kruskal Wallis = 242.911, 6df (< .001)
In-hospital mortality, n (%)	6 (0.62)	2 (0.16)	8 (0.50)	4 (0.19)	4 (0.16)	3 (0.11)	6 (0.10)	$\chi 2$=14.078, 6df (.029)
Median (IQR) Length of Stay, days	8 (7 to 10)	8 (6 to 9)	7 (6 to 9)	7 (6 to 9)	7 (5 to 8)	6 (5 to 8)	6 (5 to 8)	Kruskal Wallis= 764.885, 6df (< .001)
Number of Hospitals, n	120	126	122	122	122	119	122	–
Number of Surgeons, n	194	204	212	226	234	242	234	–

*IQR indicates interquartile range.

Table 2. Clinical outcomes of radical prostatectomy in various age groups

Variable	Age range				Test (*P*)
	<50	50 to 59	60 to 69	≥70	
Total, n	283	3930	8572	1515	–
Median (IQR) waiting time, days	34 (17 to 53)	38 (23 to 57)	40 (24 to 60)	41 (24 to 65)	Kruskal Wallis = 36.223, 3df (< .001)
In-hospital mortality, n (%)	0	2 (0.05)	17 (0.19)	14 (0.92)	$\chi 2$=38.200, 3df (< .001)
Median (IQR) length of stay, days	6 (5 to 8)	7 (5 to 8)	7 (5 to 9)	7 (6 to 9)	Kruskal Wallis= 136.935, 3df (< .001)

*IQR indicates interquartile range.

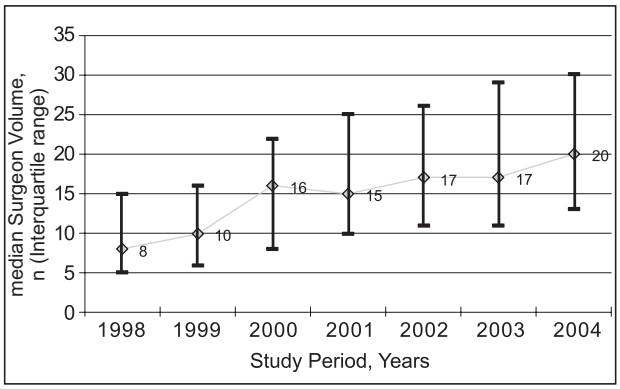

Figure 4. Error bar representing the annual surgeon volume over the study period.

waiting time (interquartile range) in patients < 50 years and ≥ 70 years was 34 days (range, 17 to 53 days) and 41 days (range, 24 to 65 days), respectively. Ninety-five percentage of mortality was seen in patients aged ≥ 60 years and none in younger (< 50 years) patients. Elderly patients (≥ 50 years) stayed longer in hospital compared to younger ones (< 50 years).

Volume Outcome Relationship

In univariate analysis, mortality rate was significantly lower in high volume (≥ 26 RP/year) hospitals compared to low volume (< 26 RP/year) hospitals (0.10% versus 0.30%, $P < .05$). In the risk adjusted multivariate analysis, mortality rate was significantly lower when comparing high volume to low volume hospitals (Odds Ratio: 0.40, 95% Confidence Interval: 0.17 to 0.90, $P = .028$). Similarly, high volume surgeons had significantly lower mortality in comparison to low volume surgeons (0.10% versus 0.40%, $P < .01$). In the risk adjusted multivariate analysis, mortality rate was significantly lower when comparing high volume to low volume surgeons (Odds Ratio: 95% Confidence Interval: 0.13 to 0.75, $P = .009$). The median length of hospital stay was lower for high volume hospitals in comparison to low volume hospitals. Likewise, high volume surgeons had shorter in-patient stay than low volume surgeons.

DISCUSSION

In proportion to the increase in number of newly diagnosed prostate cancer cases,[1] the annual number of RPs has increased by more than threefold over 7 years. An increasing trend towards laparoscopic RP over the study period was noted. In-hospital mortality and length of hospital stay was lower in younger patients and later years of study. Furthermore, mortality rate and length of in-patient stay was lower in patients treated by high volume surgeons and at high volume hospitals.

Our patients' demographics are similar to previous population-based studies from the USA.[15,16] Mortality rate from RP has been very low for many years, with majority of academic centers reporting 0% to 0.42%.[17-19] Overall mortality rate of 0.23% (present study) is comparable to the studies from the USA (0.25%).[16] Further reductions in the mortality rate (0.62% to 0.10%) over the study period could be attributed to the increase in surgical caseload and improvements in peri-operative care. Length of stay is higher than medicare population-based studies from the USA by one day.[16] Hu and colleagues suggested that surgeon volume is inversely related to in-hospital complications and length of stay in men undergoing RP.[20] Litwin and associates reported that length of stay can be further decreased by 28% with clinical care pathway design.[21] Present study has shown a significant difference in the mortality rate and length of hospital stay between the high and low volume groups in England. This analysis supports

the volume outcome relationship studies from Northern America for RP.[3,16]

There was a significant increase in the number of surgeons with almost no change in the number of hospitals performing RP over the study period. The drift towards centralization has been supported by the significant increase in the annual hospital and surgeon volume.

Administrative databases are important resources for health services research. However, because the data were collected for reasons other than answering specific research questions, the conclusions must be balanced with caveats. In-hospital mortality rate obtained from HES database, in contrast to 30 or 60-day mortality rate, could be deceptive; as hospitals with early discharge policy have higher re-admission rate and higher 30-day mortality rate.[22-24]

Concerns have been raised with coding accuracy of HES database. Various studies have confirmed the coding accuracy in the United Kingdom to be on average 92%, especially for procedure coding. [25] Furthermore, the major outcome variables (in-hospital mortality and length of hospital stay) can be extracted accurately through HES database. The audit verifying the excess deaths in Bristol pediatric cardiac surgery unit attests the accuracy of HES coding.[26]

One of the major strengths of this study lies in its population-based nature, which makes the results more easily generalizable and applicable to the majority of patients treated in various clinical settings. New British Association of Urological Surgeons database of complex operations might resolve the few obstacles of Hospital Episodes Statistics and aid in future studies.

CONCLUSION

In conclusion, there is an exponential increase in the number of RPs with an increasing trend towards laparoscopic RP in England. This study showed a significant inverse correlation between provider volume (hospital and surgeon) and outcome (mortality and length of hospital stay) for radical prostatectomy in England; thus, supporting the recommendations for centralization of major complex radical procedures, including radical prostatectomy.

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CONFLICT OF INTEREST

None declared.

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