

Robot Assisted Surgery for Partial Nephrectomy

Public Health England and BAUS summary of latest epidemiological and audit data to for the NHS England Urological Cancer Clinical Reference Group

Executive summary

- Incidence rates of kidney cancer have risen significantly in England since 2011. In 2013, there were 8,562 new diagnoses in England.
- Mortality increases since 2001 have been less marked when compared to incidence. In 2013, there were 3,125 deaths from Kidney cancer in England.
- In 2013, 60% of people receiving treatment kidney cancer had a radical or partial nephrectomy as part of their care.
- Partial nephrectomies have increased since 2009 as a proportion of all nephrectomies, whilst over the same period the proportion of patients receiving a radical nephrectomy has declined.
- Of all nephrectomies, only 4% were recorded as being undertaken using a robotic surgical approach in 2012/2013. 18% of all partial nephrectomies were undertaken using robotic approaches.
- For partial nephrectomy, the data indicates some statistical significant differences when compared to laparoscopic and open approaches, notably in relation to blood loss and length of stay.
- For other outcome measures including 30 and 90 day mortality, there were no statistical significant differences observed when comparing robotic approaches with laparoscopic and open approaches.
- This analyses highlights the increasing use of robotic approaches in relation to partial nephrectomies, and some evidence of improved and equivalent clinical outcomes when compared to laparoscopic and open approaches.

Introduction

In 2013, over 11,000 people were diagnosed with kidney cancer in the UK. In the same year around 4,300 people died from this cancer. Removal of the kidney (nephrectomy) is the main treatment option for localised tumours, and in England there were nearly 4,900 hospital admissions for this procedure for cancer (NCRS data).

About 1,406 of these nephrectomies were partial i.e. only removing part of the kidney. The intention of partial removal is to preserve some kidney function.

NHS England commissions specialist surgery for kidney cancer in England, as set out in the Specialised Services manual. This report has been produced to support NHS England's Urological Cancer Clinical Reference Group (CRG) and NHS England Cancer Programme of Care Board in the development of policy relating to Robotic Assisted Surgery for Kidney Cancer in England.

Aims:

The intention of the document is to:

- Present trends in kidney cancer incidence and mortality
- Present trends in radical and partial nephrectomies
- Present analysis of data on nephrectomies supplied by the British Association of Urological Surgeons.

Methods:

New cases of kidney cancer were obtained from the National Cancer Registration Service (NCRS), and defined by a diagnosis with ICD-10 code C64. Deaths data was obtained from the Office for National Statistics, for deaths with an underlying cause code of C64. Incidence and mortality rates are presented as directly age-standardised rates using the 2013 European Standard Population.

Data on nephrectomy was obtained from Hospital Episode Statistics for admitted patient care, which are held by NCRS but produced by the Health and Social Care Information Centre. All people diagnosed with kidney cancer were linked to HES to look for admissions containing procedure codes M02.1-M02.9 for radical nephrectomy and codes M03.8-M03.9 for partial nephrectomy.

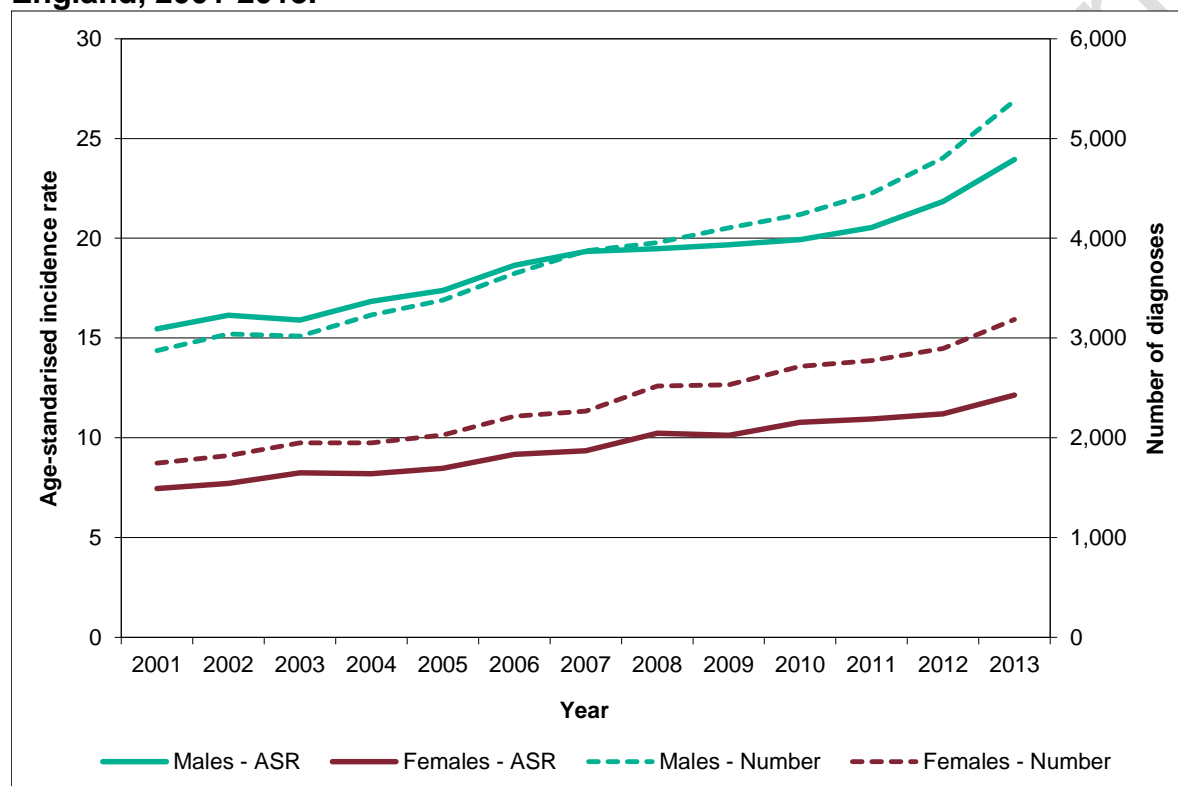
The British Association of Urological Surgeons (BAUS) collects detailed data on nephrectomies as part of its audit scheme. The audit is a mandated speciality within the Consultant Outcomes Publication COP project, with about 90% of nephrectomies recorded when compared to HES data for 2013 (BAUS website). There are multiple data items recorded by BAUS which are not recorded in HES, including the margin status, pre-operative complications and blood transfusions.

Results:

Incidence of kidney cancer

Numbers of cases and age-standardised rates of kidney cancer have been increasing for over a decade. In 2013 there were 5,377 new diagnoses in men compared to 3,185 in women, the ASR (per 100,000) was 23.9 in men and 12.1 in women.

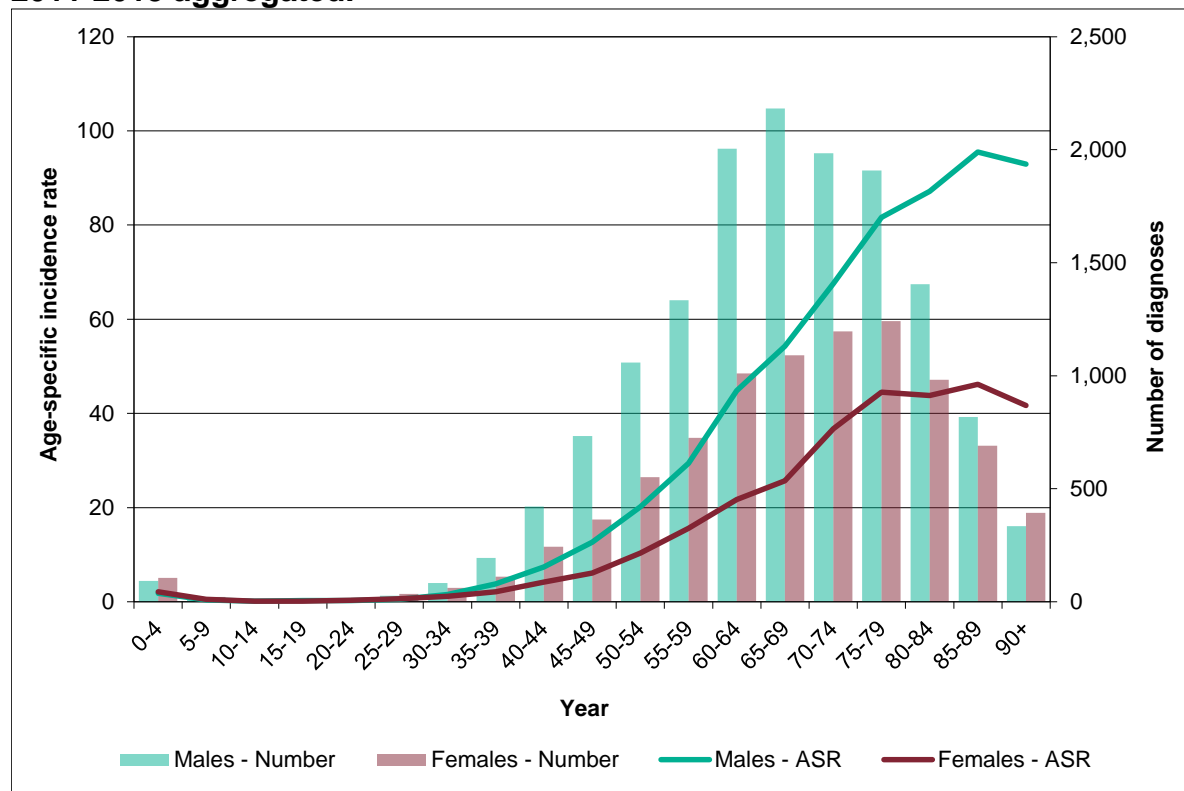
Age-standardised incidence rates of kidney cancer (ICD-10 code C64) for England, 2001-2013.



Source: NCRS

For 2011-13 aggregated data the number of cases for men peaks in the 65-59 age-group although the highest age-specific rate is in those aged 85-59. For women the maximum number of cases occurs in those aged 75-79 with the highest rate in those aged 85-89. However for women there is only a small difference in age-specific rate for all age-groups 75 and over.

Age-specific incidence rates of kidney cancer (ICD-10 code C64) for England, 2011-2013 aggregated.



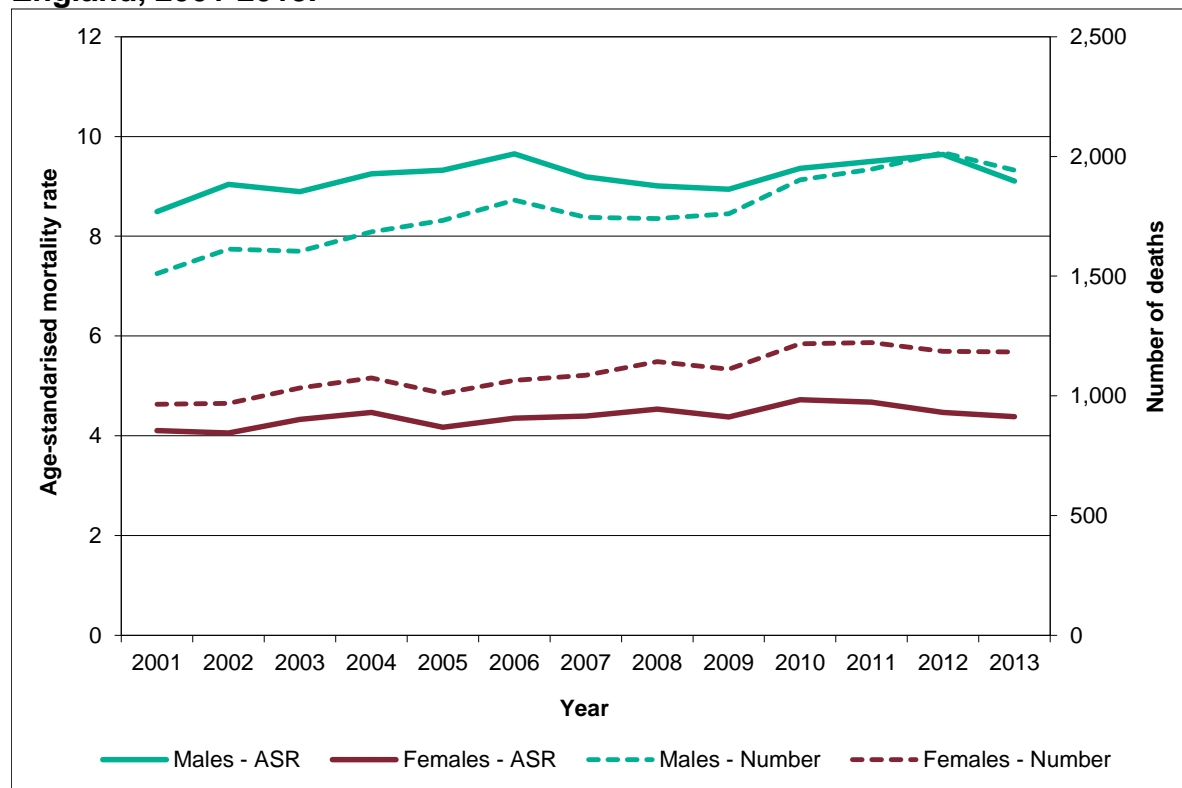
Source: NCRS

Mortality from kidney cancer

There has been some increase in mortality rates and number of deaths from kidney cancer since 2001, although the increase is not as large as the increase in incidence. In 2013 there were 1,942 deaths in men compared to 1,183 in women, the ASR (per 100,000) was 9.1 in men and 4.4 in women.

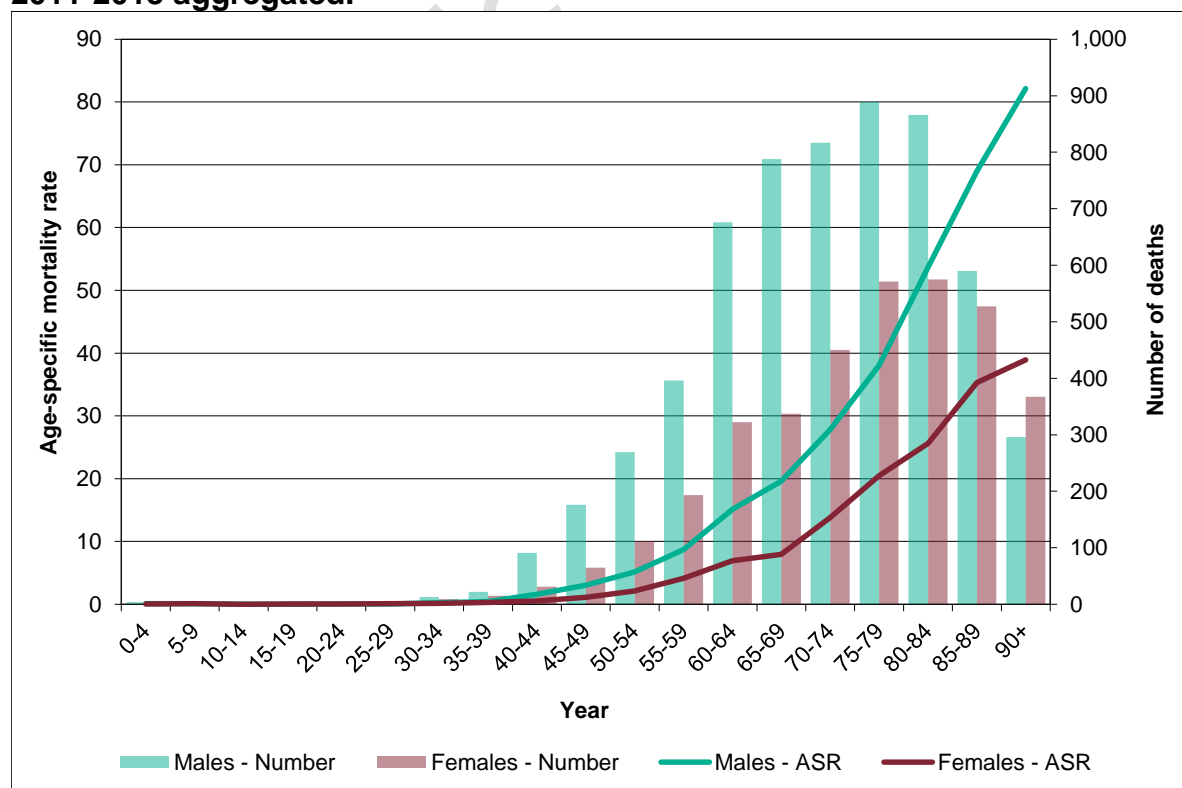
The most common age at death for men was 75-59, with mortality rates increasing to a peak in those aged 90+. In women the number of deaths in those aged 75-59 was almost exactly equal to those aged 80-84, but as for men the highest rate was in those aged 90+.

Age-standardised mortality rates of kidney cancer (ICD-10 code C64) for England, 2001-2013.



Source: ONS

Age-specific mortality rates of kidney cancer (ICD-10 code C64) for England, 2011-2013 aggregated.

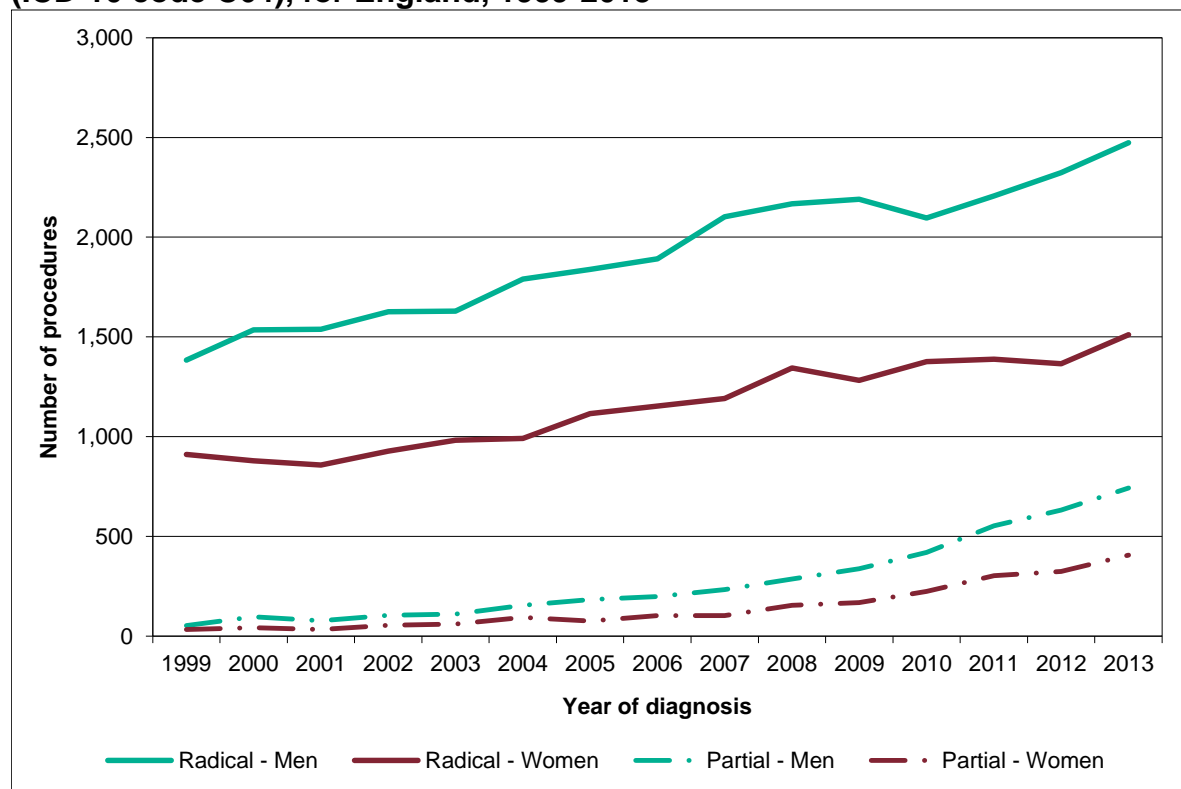


Source: ONS

Nephrectomy data from HES

The number of nephrectomies performed for kidney cancer has risen broadly in line with the rising number of diagnoses. For those diagnosed in 2013 there were 2,474 radical nephrectomies performed in men, and 1,511 in women. There 743 partial nephrectomies performed in men, and 407 in women.

Number of radical and partial nephrectomies performed for kidney cancer (ICD-10 code C64), for England, 1999-2013

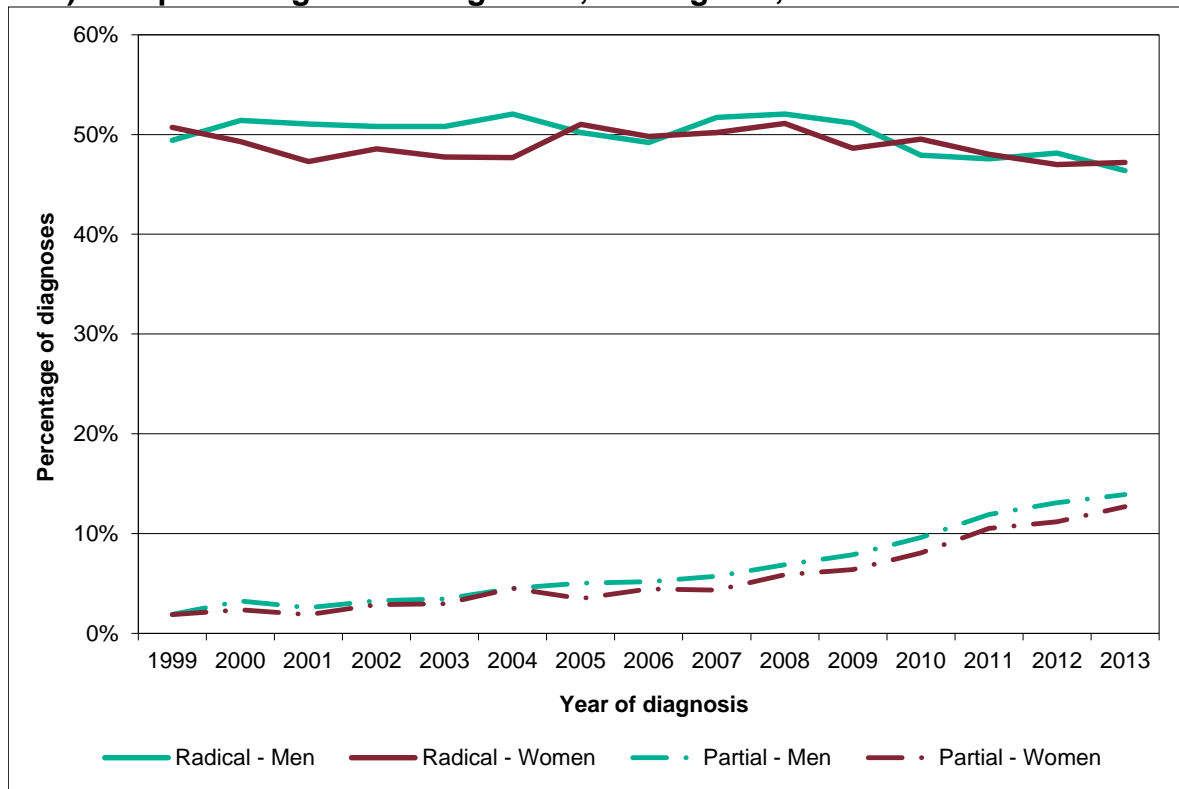


Source: NCRS and HES

As a percentage of all diagnoses, around half had a radical nephrectomy. This appears to have decreased slightly in the latest five years as partial nephrectomies have increased. The percentage of patients receiving any nephrectomy has increased since 1999 and was 60% in 2013 for both men and women. There is no difference in percentage of men or women receiving partial nephrectomy.

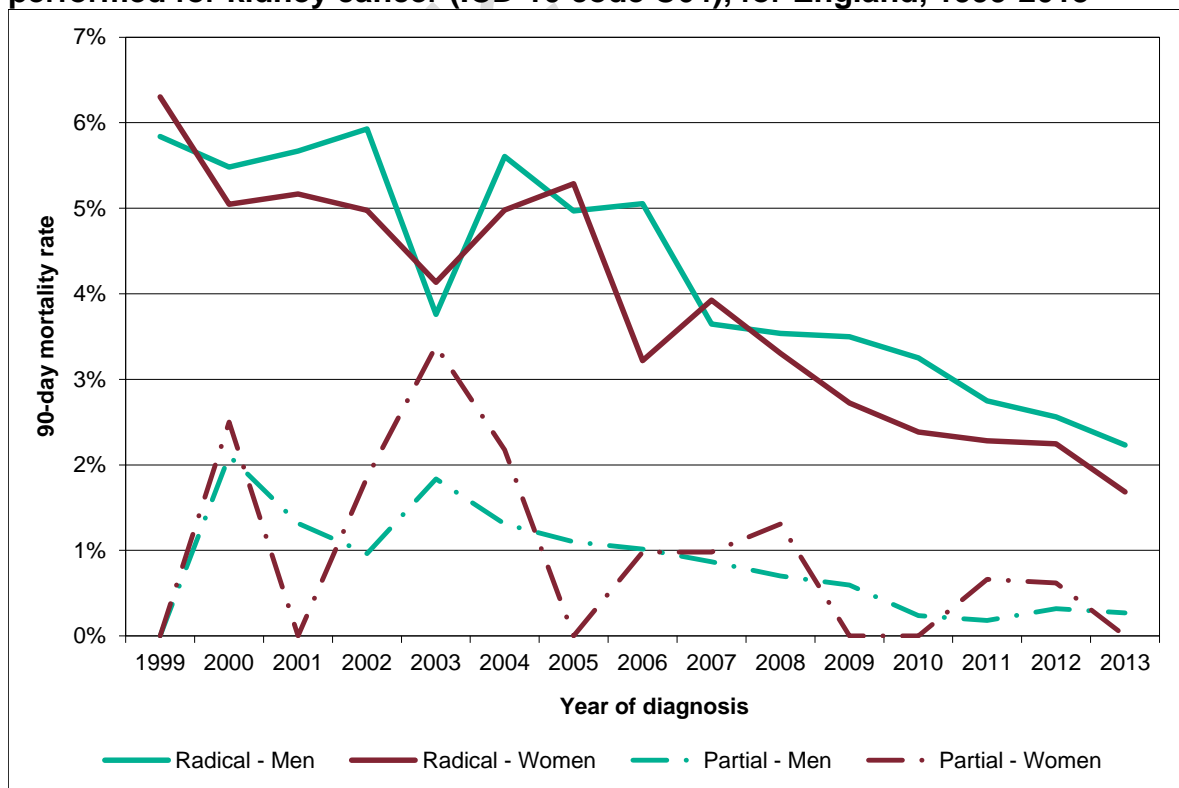
The percentage of people dying within 90 days of their nephrectomy has decreased over time, and was 3% of men and 2% of women in 2013. The mortality rate after partial nephrectomy has always been low, possibly due to this procedure predominantly being performed for small tumours. Combined with the smaller number of procedures, this means the trends are erratic.

Radical and partial nephrectomies performed for kidney cancer (ICD-10 code C64) as a percentage of all diagnoses, for England, 1999-2013



Source: NCRS and HES

90-day mortality after nephrectomy as a percentage of all nephrectomies performed for kidney cancer (ICD-10 code C64), for England, 1999-2013



Source: HES and ONS

Nephrectomy data from BAUS

These results reflect the data supplied by BAUS for this project. The number of nephrectomies recorded for 2012 and 2013 has since increased slightly to 13,825.

All nephrectomy

- In 2012 and 2013 there were 13,765 nephrectomies recorded on the BAUS audit; 59% of these were performed on men.
- 11% of patients were recorded as having warm ischaemia; 4% recorded as cold ischaemia.
- 54% of cold ischaemia lasted less than 30 minutes. 84% of warm ischaemia lasted less than 30 minutes.
- 4% of procedures were recorded as being robotically-assisted. Only 2% had no technique recorded.
- 54% of procedures were in those aged 60-79 (29% 60-69; 25% 70-79)
- 20% of procedures were done for G2 tumours, 21% in G3 tumours. However, only 50% had a grade recorded.
- 30-day mortality was 0% in 2012 and 0.3% in 2013.
- 90-day mortality was 0% in 2012 and 0.4% in 2013.
- In 2012 138 trusts recorded nephrectomies, with a median of 36 procedures, a minimum of one and a maximum of 231. In 2013 146 trusts recorded nephrectomies, with a median of 39 procedures, a minimum of one and a maximum of 295.
- In 2012 18 trusts recorded robot-assisted nephrectomies, with a median of seven procedures, a minimum of one and a maximum of 45. In 2013 21 trusts recorded robot-assisted nephrectomies, with a median of 12 procedures, a minimum of one and a maximum of 64.
- There are three grade fields for nephrectomy: ASA grade, nuclear grade, and biopsy grade.
 - ASA grade was not recorded for 47% of cases, and was 2 for 27% of cases.
 - Nuclear grade was not recorded for 50% of cases, and was G2 for 21% of cases and G3 for 20% of cases.
 - Biopsy grade was not recorded for 96% of cases.

Partial nephrectomy for malignancy

- In 2012 and 2013 there were 1,970 partial nephrectomies for malignancy recorded on the BAUS audit (about 14% of all nephrectomies); 64% of these were performed on men.

- 18% of procedures were recoded as being robotically-assisted and 52% as open. Less than 1% had no technique recorded.
- 62% of patients were recorded as having warm ischaemia; 24% recorded as cold ischaemia.
 - 95% of robotically-assisted procedures used warm ischaemia, none used cold ischaemia.
 - 40% of open procedures used warm ischaemia, 45% used cold ischaemia.
 - 79% of laparoscopic procedures used warm ischaemia, 1% used cold ischaemia.
- Warm ischaemia lasted a median of 18 minutes for robotic, 16 minutes for open, and 19 minutes for laparoscopic procedures.
- Cold ischaemia lasted a median 15 minutes for open, and 19 minutes for laparoscopic procedures.
- 54% of robotically-assisted procedures were in those aged 50-69 (24% 50-59; 29% 60-69)
- 56% of open procedures were in those aged 50-69 (24% 50-59; 32% 60-69) with 21% in those aged 70-79
- 57% of laparoscopic procedures were in those aged 50-69 (24% 50-59; 33% 60-69)
- 30-day mortality was negligible; with only three deaths recorded.
- Most patients lost <500 ml blood: 82% of robotically assisted, 69% of open and 78% of laparoscopic procedures.
 - p-value for laparoscopic vs robotic = 0.106
 - p-value for open vs robotic < 0.001
 - The open data has more unrecorded blood loss data than RAS ($p=0.014$) so there could be the possibility of bias in missing data. In the most extreme situation that all the missing data was <500, then it would give an 82% (same as RAS) <500ml proportion. If however you assume the missing data for both open and RAS procedures is unbiased and proportionally distributed then the difference remains statistically significant.
- Categorising blood loss by those patients who did not require a transfusion showed that 91% of robotic procedures were recorded as having nil units transfused, compared to 83% of open procedures and 88% of laparoscopic procedures.
 - p-value for laparoscopic vs robotic = 0.26
 - p-value for open vs robotic < 0.001

- The difference in missing data should be noted as above.
- Clavien-Dindo complications are recorded as free text and difficult to analyse. 88% of patients having robotically-assisted procedures, 82% of those having open procedures, and 83% of those having laparoscopic procedures had no complications recorded.
 - Using highest recorded grade as the value, the most common grade was Grade II; this was also the median grade for all techniques
 - There was no statistical difference in the percentage of procedures for people with Grade III or higher complications; the percentages were 6% for open and laparoscopic and 4% for robotic
- Charlson score is also difficult to analyse. 63% of patients having robotically-assisted procedures, 77% of those having open procedures, and 74% of those having laparoscopic procedures had no conditions from the Charlson index listed.
- Median length of stay was 3 days for robotically-assisted procedures, 5 days for open procedures and 4 days for laparoscopic procedures.
 - p-value for open vs robotic < 0.001
 - p-value for laparoscopic vs robotic < 0.001
- Both pathological and clinical stage indicated that most procedures were undertaken in those with stage I cancer. There was a larger number of stage IV cases recorded for clinical stage.
- In 2012 80 trusts recorded partial nephrectomies for malignancy, with a median of 6 procedures, a minimum of one and a maximum of 40. In 2013 82 trusts recorded partial nephrectomies for malignancy, with a median of 9 procedures, a minimum of one and a maximum of 57.
- In 2013 13 trusts recorded robot-assisted partial nephrectomies for malignancy, with a median of 6 procedures, a minimum of one and a maximum of 22. In 2013 18 trusts recorded robot-assisted partial nephrectomies for malignancy, with a median of 12 procedures, a minimum of one and a maximum of 37.
- The percentage of partial nephrectomies recorded as resulting in positive margins was 5% for robotically-assisted procedures, 6% for open procedures, and 6% for laparoscopic procedures. Around 18% of procedures did not record margin status.

Volume measures

- Volume-outcome relationships were assessed for partial nephrectomy for malignancy only
- The evidence for a volume outcome relationship was assessed using two groupings of centres.

- Firstly in two groups of less than 20 or 20 or more procedures
- Secondly in three groups of less than 20, 20-39 and 40 or more procedures
- For comparison of two groups, there was a shorter median length of stay in centres which did 20 or more procedures, at 3 days compared to 4 days ($p < 0.001$).
- There was insufficient evidence of a difference in outcomes by surgical volume when centres were split into three groups.

Limitations and caveats

The BAUS audit is not totally complete (based on comparison with HES) but has high completeness the only feasible way to compare robotic, laparoscopic and open approaches as this data is poorly recorded in HES.

For public consultation

Conclusions:

The analyses above indicates that robotic approaches are currently a small proportion of overall nephrectomies performed (4%), with the greatest proportion of robotic activity performed for partial nephrectomy (18% of all procedures)

For partial nephrectomy, the data indicates some statistical significant differences when compared to laparoscopic and open approaches, notably in relation to blood loss and length of stay. In relation to blood loss there was significant differences between open and robotic approaches in relation to the number of patients requiring a post-operative transfusion. In laparoscopic, a positive difference was also noted in comparison with RAS, though not statistically significant.

Positive differences were also noted in relation to RAS in terms of post operative complications when used to perform partial nephrectomy procedures, although this was confounded by data completeness and the translation of free-text data within the analyses.

There was evidence that centres which performed 20 or more procedures in the time-period studied had shorter length of stay after partial nephrectomy for malignancy.

The 30-day mortality rate in all groups was negligible and no comparisons could be made.

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