



## Impact of centralization of services on outcomes in a rare tumour: Retroperitoneal sarcomas



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### ABSTRACT

**Background and aim:** The retroperitoneal tumor (RPT) service in the North West costal region of England was centralized in May 2011 by the merger of the Merseyside, Cheshire and Lancashire, Cumbria sarcoma networks. Our aim was to analyze the impact of centralization of services on patient outcomes.

**Methods:** An analysis from 01/12/2004 to 30/11/2017 was undertaken from prospectively maintained database and electronic patient records; follow-up was until 30/04/2018. This time period encompassed 6.5 years before and after centralization of services took place. Survival analysis was done for Retroperitoneal Sarcomas (RPS) and also compared the impact of centralization.

**Results:** 72 patients (27 men), median age 69 (21–90) years) underwent 95 operations with an intention to excise RPS. Overall there were 52 (54.7%) multi-visceral resections (MVR). 91/95 (95.8%) patients with primary tumors had surgery with a curative (R0/1) intent. 30-day and 90-day operative mortality was 3.2% (n = 3) and 4.2% (n = 4) respectively. The 5-year survival for patients undergoing resection for RPTs was 51.3%. 79 (83.1%) of the resections in this series occurred in the 6.5-years post-centralization with an increase in MVR between the two time points (p < 0.0006). Despite the more radical nature of surgery post-centralization, there was no difference in 5-year survival for RPS patients when compared to pre-centralization, p = 0.575. However the 5-yr survival post-centralization compared favorably to national outcomes.

**Conclusion:** Centralization in the management of RPS has resulted in an increase in resection rates and more complex MVRs, without compromising R0/1 resection rates; peri-operative mortality or overall survival.

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### Introduction

Retroperitoneal tumors (RPT) are rare, with sarcomas being the commonest histological sub-type. Benign RPTs are also encountered but excision still remains the main modality of treatment both for diagnosis and symptom relief. This also forms part of services offered by a sarcoma surgeon. Retroperitoneal sarcomas

(RPS) only account for approximately 10%–15% of all soft-tissue tumors. RPS are malignant tumors arising from mesenchymal cells, which are usually located in muscle, fat, and connective tissues. They have varying clinical courses depending on their histologic subtype and grade. The rarity of RPS, combined with the vast array of histologic subtypes, render provision of optimum management compromise in centers treating small number of patients. Retroperitoneal sarcomas constitute a therapeutic challenge because of their relative late presentation and anatomical location, often in close relationship with multiple vital structures in the anatomically complex retroperitoneal space.

Wide surgical excision remains the mainstay of treatment nevertheless, the large size of these tumors and their proximity to

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vital structures and visceral organs make the surgical procedure complex and challenging. Potential strategies to improve outcome would involve referral to tertiary/high volume centers, achieve R0 resection and optimal extent of surgical resection that requires multi-visceral resection (MVR) [1–3]. Multimodality combined treatments of chemotherapy and radiotherapy plus surgery are under investigation [4], but definitive evidence of their efficacy is unavailable so far [5–7]. Local recurrence remains a problem occurring in 40%–80% of the cases [8] and 5-year survival is approximately 56.4% for primary RPS [8]. For the above reasons, RPS are best managed by a multi-disciplinary team in a tertiary center.

Retroperitoneal tumor services started in Liverpool in 1995 at the Royal Liverpool University Hospital. All hospitals in the Merseyside network consolidated referrals to the Sarcoma MDT in 2009. Lancashire and South Cumbria Cancer network joined the Merseyside network in mid-2011. This centralized service with one specialist MDT based at Royal Liverpool and Broadgreen University Hospitals caters to a population of 3.9 million in the northwest coastal region of the United Kingdom.

The aim of our study was to evaluate the impact of centralization of RPS resectional services on patient outcomes and to compare these outcomes with those within the national sarcoma registry.

## Methods

All patients who underwent surgery to excise RPS between 01/1/2004 to 30/11/2017 in the North West coastal region were analyzed. Data was collected from prospectively maintained database and electronic patient records. Patient demographics, operative details, histology of RPTs and outcomes on follow-up were collected. In addition data was obtained from the national sarcoma registry into order to analyze the total incidence of disease [9]. Survival analysis was undertaken using Kaplan-Meier curves (SPSS, Chicago, IL Version 14) to compare survival before and after centralization. Comparison of Liverpool data post-centralization with national registry data was made at a 5-yr time point using Chi2 and Bapista-Pike (odds ratio). Follow-up was completed up to 30/04/2018.

## Results

A total of 72 patients (27 men) underwent attempted resection of a RPS. The median age was 69 (21–90) years. In addition there were 23 re-resections amongst 14 patients who developed recurrent RPS. Thus in total 95 operations were undertaken with an intention to excise RPS.

**Table 1**  
Histology – subtypes.

Histology - subtype	Primary	Recurrent
Leiomyosarcoma	24	6
Ewings sarcoma	2	1
Undifferentiated Sarcoma	1	
Rhabdomyosarcoma	1	
Angiosarcoma	1	
Liposarcoma – sclerosing	4	5
De-differentiated liposarcoma	15	1
Liposarcoma	20	9
Myxoid liposarcoma	1	1
Lipoma-like liposarcoma	1	
Dermatofibrosarcoma protuberans	1	
Low grade myofibroblastic sarcoma	1	

**Table 1** summarizes the histology of the 95 excised tumors. As can be seen 43/72 (59.7%) patients had a diagnosis of a primary liposarcoma. 52/95 (54.7%) of these resections were multi-visceral. Based on histological analysis, ninety-three structures were excised as part of the retroperitoneal resection and the commonest was colon, followed by the kidney (**Table 2**). There were also 9 major vascular resections undertaken. In total 91/95 (95.8%) of cases, the surgery was undertaken with a curative (R0/1) intent.

30-day and 90-day operative mortality was 3.2% (n = 3) and 4.2% (n = 4) respectively. The overall 5-year survival for patients undergoing resection for RPSs was 51.3%. The overall local recurrence rate in this series was 20%. The overall 5-year survival for primary versus recurrent RPS was 55% compared to 39%, p = 0.580.

## Impact of centralization

**Table 3** demonstrates the impact of centralization on outcomes. 79/95 (83.1%) of the resections in this series occurred in the 6.5-years post-centralization. This translates into an increase in the actual mean numbers of resections performed per year from 2.5 to 12.2. Furthermore, 20/23 re-resections in this series were performed post-centralization. In addition there was an increase in multi-visceral resections (p < 0.0006) between the two time points. This in turn may reflect on the local recurrence rates, which has improved from 38.5% to 16% before and after centralization respectively.

Despite the increased complexity of surgery with centralization, there was no difference in 90-day mortality between the two time periods, p = 0.677.

The 5-year survival for all primary resections post-centralization was 60% compared to 46% pre-centralization, p = 0.575 (**Fig. 1**).

**Table 2**  
Structures removed as part of multi-visceral resection based on histology reports.

Organ	No
Appendix	1
Ovary	1
Psoas and iliacus	1
Duodenum	2
Gall bladder (not involved)	2
Diaphragm	2
Iliac vessels	2
Abdominal wall	3
Stomach	4
Adrenal gland	4
Urinary bladder	4
Ureter	4
Liver	5
Pancreas	5
Spleen	6
Inferior vena cava	7
Small bowel	7
Kidney	16
Colon	17

**Table 3**  
Comparison between pre- and post-centralization.

	Pre-centralization	Post-centralization
Number of patients	13	59
Re-resections	3/13 (23%)	20/59 (33.9%)
Overall number of resections	16 (16.8%)	79 (83.2%)
Average resections/year	2.5	12.2
Multi-visceral resection	2/16 (12.5%)	50/79 (63.3%)
Local Recurrence	5/16 (31.2%)	10/79 (12.7%)

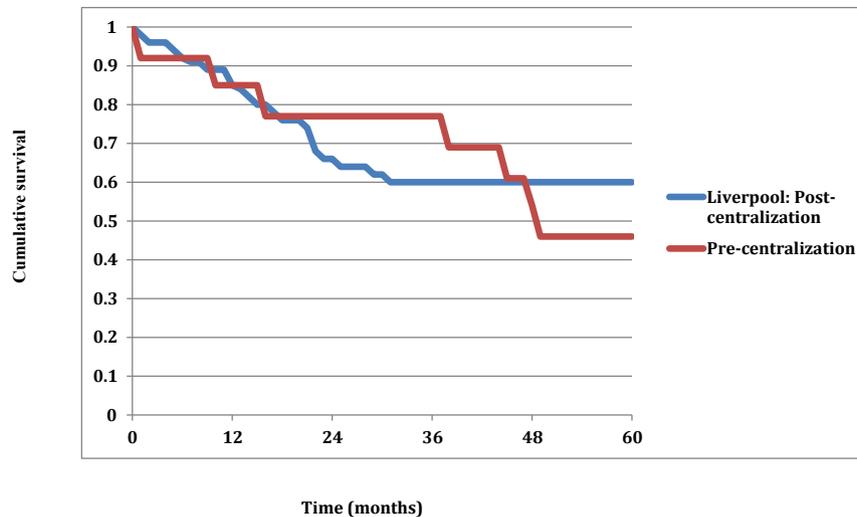


Fig. 1. Pre-versus post-centralization survival analysis for primary RPS resection.

### Comparison with national sarcoma cancer registry data

Data from the national sarcoma registry, which was available from 2005 to 2015, was reviewed (Fig. 2). In the earlier part of this study up to 2011, the age adjusted national annual incidence of RPS was 0.257/100,000 of population. This translated into an overall population based incidence in our original Merseyside network of 43 primary RPS of whom 13 (30.2%) underwent resection. In the latter part of this study the age adjusted national annual incidence was 0.274/100,000 population. This translated to 69 primary tumors, 59 (85.5%) of which were resected,  $p < 0.001$ .

The overall survival at 5-yr for resected primary RPS within the national registry over the time period of this study was 40.6% (Fig. 3). The 5-year survival, post centralization, in our series for primary RPS is 60%. This compare favorably with the national results,  $p = 0.0027$ ; Odds ratio 2.262 (1.226–3.911) (Fig. 4).

### Discussion

Retroperitoneal sarcomas (RPS) are rare tumors composed of several well-defined histologic subtypes and behaviors. Although

UK 5-year survival remains on par with international centres [10–12], there is still room for improvement. The reasons for this are multi-factorial including lack of awareness in primary and secondary care and therefore delay in referral to expert centres [13]. National Institute for Clinical excellence (NICE) recommended centralizing services for sarcomas in 2006 to improve outcomes in sarcoma patients. Recent NICE guidelines (2014) has stated that “outcomes for people with retroperitoneal sarcoma will be improved by concentrating their treatment at centers with staff who are experienced in managing this type of tumour” [14].

This paper examines the outcomes for patients with RPS as well as the impact of centralization of RPS services within our region. Our study cohort reflects similar demographics as presented in international literature with respect to patient demographics and tumor histology [13,14]. The main stay of treatment remains R0/R1 resection in RPS [4]. In our series 95.8% of patients had R0/R1 resection with curative intent.

The outcomes from established RPS reference centers are well-established [11,15]. In our series, 85.5% of patients within our tumor board underwent a potentially curative resection. This is similar to the results from larger series such as NetSarc network which has shown that resection rates were 76% in sarcoma centers vs 55% in centers outside Netsarc ( $p < 0.000001$ ) [16]. At present, numbers of resections undertaken each year within our unit compare favorably with those from established reference centers [10]. This is also the case for overall survival for our series [14]. The rates of MVRs within our series, which post centralization was 63.3%, however appeared to be lower than those from the reference centers. This may be due to the fact that we are only reporting whole organs that have been identified within the resection at pathological analysis, thus we may be under-reporting partial resections of the psoas muscle. Despite this, the local recurrence rate within our series compared favorably with the published literature [9,14].

Our study confirms the advantages of centralization in managing a complex and rare disorder [17,18]. We have demonstrated an increase in proportion of patients with our region who underwent resection and more complex MVRs, without compromising R0/1 resection rates, peri-operative mortality or oncological outcomes. Furthermore, when compared to nationally available outcome data, post-centralization our survival outcomes compare favorably with the national data for surgery in this rare cancer.

There are many limitations in our study that involves analysis of retrospective data. It is a retrospective study of a rare condition

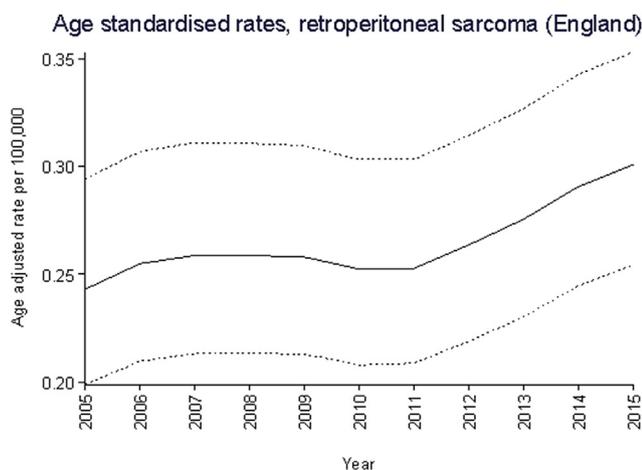


Fig. 2. National sarcoma registry data (England) – age adjusted incidence.

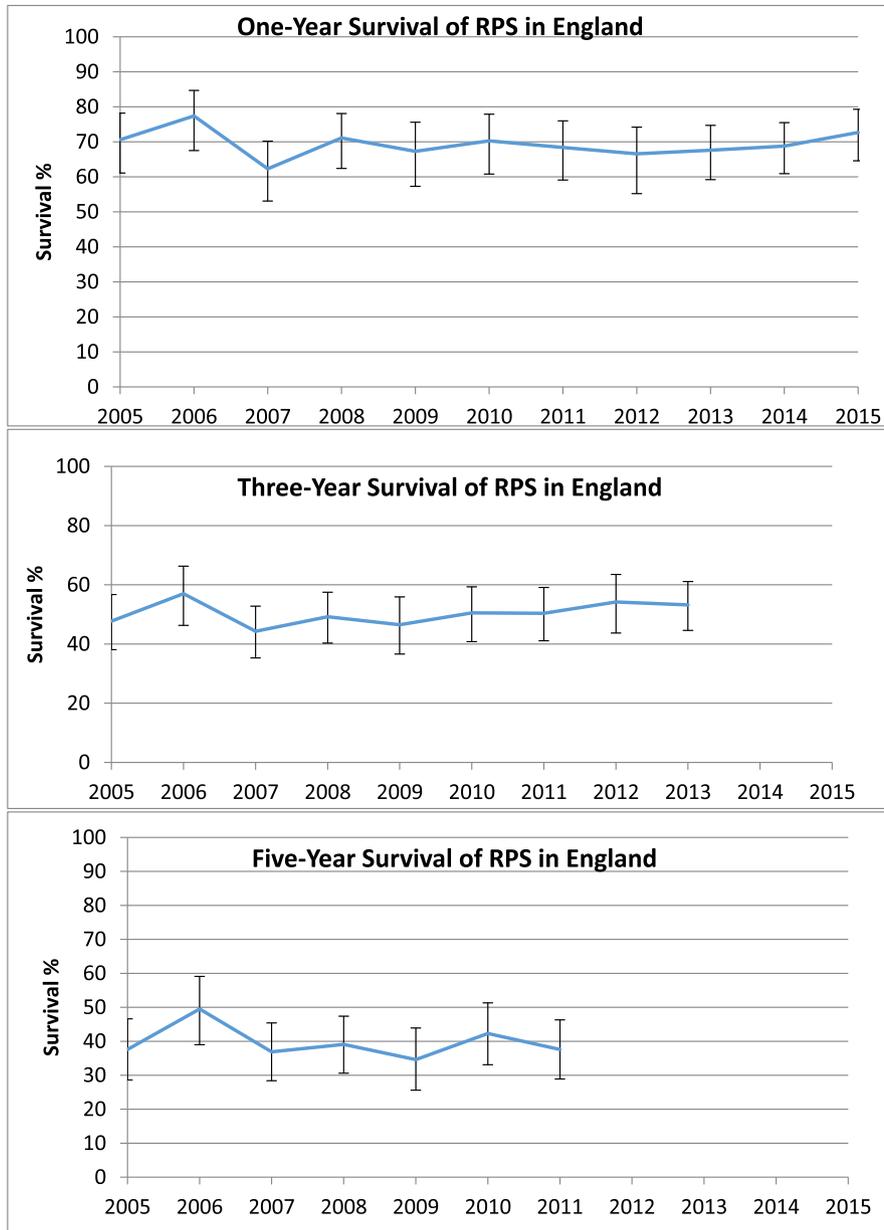


Fig. 3. National sarcoma registry data (England) – survival.

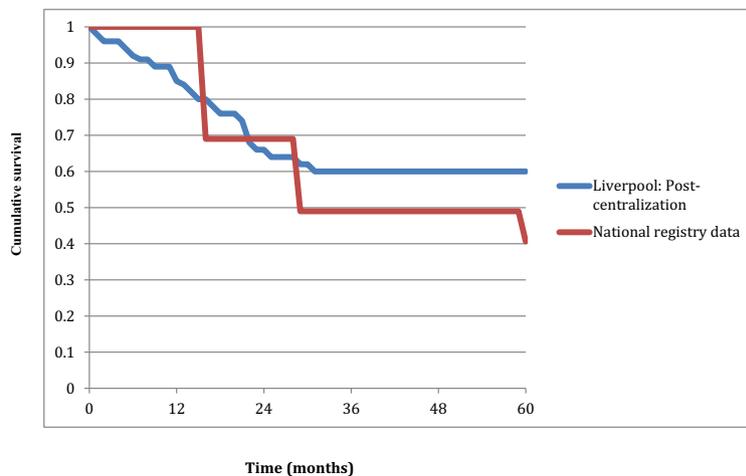


Fig. 4. Comparison of outcomes for RPS resections – national registry versus Liverpool (post-centralization) data.

with the inherent difficulty in obtaining accurate incidence and treatment data. We have included the available national RPS data recently provided by Public Health England. There is significant time lag of National five year survival data. However we hope that our paper will help to emphasize the importance of centralization of services for RPS - improved referral, resection and survival figures'.

### Conclusion

Centralization in the management of this rare tumor has resulted in an increase in a proportionate increase resection rates within our population, as well as more complex MVRs, without compromising R0/1 resection rates; peri-operative mortality or overall survival.

### Funding

None.

### Conflicts of interest

None.

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