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Volume-outcome relationship in penile cancer treatment: a population based patterns of care and outcomes study from Australia

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Abstract

Objectives

To study the patterns of care of penile cancer diagnosed in the state of New South Wales (NSW) over a 10 year period and determine factors that are associated with differences in survival.

Patients and Methods

All invasive penile cancer diagnosed between 2001 and 2009 in NSW, Australia, were identified from the Central Cancer Registry. Records of treatment from the Admitted Patient Data Collection and deaths from the Registry of Births Deaths and Marriages were electronically linked. Predictors of receiving an inguinal lymph node dissection (ILND) were analysed using multivariable logistic regression. Survival analyses were performed with Kaplan-Meier and Cox proportional hazards models.

Results:

A total of 220 men were diagnosed with penile cancer over the 10 years from 69 centres. The median number of penile operations performed over 10 years was <4. Radical penile surgery (partial or total penectomy) was performed in 70% of the cases and the proportion of patients receiving radical surgery increased over time (p=0.015).

Only 53/220 men with invasive penile cancer received an ILND. Younger age and higher stage were the only factors that predicted whether ILND was performed.

Overall survival (OS) was predicted by age, stage, marital status and co-morbidity status. Low centre volume decreased OS by 37% (HR 0.63 (95%CI 0.40-0.97)). For men who received ILND, low centre volume decreased OS by 60% (HR 0.40 (95%CI 0.19-0.85)).

Conclusions

There is a decreasing trend for the use of conservative penile surgery and median centre volumes for penile cancer surgery in NSW are low. A decrease in overall survival is observed in men treated in lower volume surgery centres.

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Introduction

Squamous cell carcinoma (SCC) of the penis is a rare disease and accounts for <0.5% of all male cancers in the USA and Australia.[1] Known risk factors include tobacco smoking[2], low socio-economic status [3], phimosis [4] and HPV infection[5]). In Australia the age-standardised incidence of penile cancer is 0.80/100,000 man years and is lower than the UK (1.44) but higher than the USA (0.66).[6] A similar pattern has been observed with penile cancer mortality across these three countries.[6] Interestingly, unlike the USA and UK, there is a statistically significant trend towards increasing incidence of penile cancer in Australia.[6]

The rarity of this disease has led the National Institute of Clinical Excellence in the UK to recommend that all men with penile cancer in the UK be managed in supra-regional centres. It has also been recommended that each centre treats a minimum of 25 new cases per year.[7] In Australia there are no such guidelines for centralisation and there is a paucity of data on how penile cancer is currently managed. As a result, determining the benefits or costs of centralisation remains difficult.

This study aims to outline the patterns of care for penile cancer diagnosed in the state of New South Wales, Australia over a 10 year period and determine factors that associated with differences in survival.

Methods

Patients

Data for all cases of penile cancer diagnosed in New South Wales (NSW) were obtained from the NSW Central Cancer Registry (CCR). Operational details of the Registry have been described previously [8]. Notifications to the CCR of invasive penile cancer (ICD-10 code: C60-C60.9) diagnosed in NSW are mandated from pathology laboratories, hospitals and other treatment centers under the NSW Public Health Act 1991. For this study all registered cases diagnosed between January 2001 and December 2009 were eligible. Hospital admission and treatment details were retrieved by linkage to the NSW Admitted Patient Data Collection (APDC) on all hospital separations in

NSW in the period January 2001 to end of December 2011. Hospital medical coders abstracted individual patient information from medical records following the patient's discharge from any hospital in the state of NSW. This includes dates of admission and separation, procedures undertaken and diagnoses relating to the hospital episode. Death information was obtained by electronic linkage of the records from the CCR with NSW death records from the Registry of Births Deaths and Marriages. (January 2001 to end of December 2011) and Australia Coordinating Registry Cause of Death Unit Record File(January 2001 to end of October 2007). Only overall survival outcomes were reported because the cause of death data was unavailable after 2007. Linkage of records in these data sets was carried out by the Centre for Health Record Linkage (CHeReL), using probabilistic matching carried out with ChoiceMaker software (ChoiceMaker Technologies Inc., New York, US). This linkage was performed using name, address, date of birth, date of diagnosis and hospital-recorded clinical information that identified cases common to all data sets, and clerical reviews for questionable matches were undertaken by trained staff within the CHeReL.

Individuals diagnosed with penile cancer were classified by: (i) age at diagnosis categorized in decades; (ii) country of birth, developed verses developing world; (iii) two ordinal categories using the residential local government area-based Accessibility/ Remoteness Index of Australia (ARIA)[9]; (iv) stage at diagnosis was based on the CCR classification of stage at first presentation. This was determined as the maximum extent of the cancer based on all reports and notifications received by the Central Cancer Registry within four months of diagnosis. This classification follows the international coding guidelines for summary stage adopted by the World Health Organization and the International Association of Cancer Registries.[10] Extent was grouped as localised (cancer was limited to the penis), regional (cancer extended outside the penis to lymph nodes in the pelvic area), distant (cancer in has spread to more distant lymph nodes, entered the blood stream or metastasized to other parts of the body) or unknown degree of spread, (v) Marital status, defacto relationship was grouped with married; (vi) Charlson comorbidity index (CCI) was used to catagorise comorbidity; hospital case volumes of penile procedures

dichotomized about the median. The most significant/radical penile procedure was identified as the definitive procedure, for example. If a man had a biopsy or circumcision followed by a partial penectomy, the partial penectomy was the definitive procedure. Radical penile surgery was defined as partial or total penectomy. Conservative penile surgery was defined as a lesser procedure that preserved the main penis eg. Circumcision or partial glansectomy. An inguinal lymph node dissection (ILND) included any cases where excisional biopsy of lymph nodes in the inguinal region was performed- this includes sentinel node biopsy.

Statistical Analysis

Multivariable logistic regression analysis was used to analyse predictors of receiving a ILND. The proportion of men with penile cancer dying within 5 years of diagnosis were calculated using Kaplan–Meier product-limit estimates. Multivariable survival analyses were performed with the Cox proportional hazard regression model. Statistical significance in this study was considered at $p < 0.05$. All reported p values are 2-sided.

All analyses were carried out in SAS version 9.3 (SAS Institute Inc., Cary, NC, US). The NSW Population and Health Services Research Ethics Committee approved this study (Approval number HREC/10/CIPHS/21).

Results

A total of 220 men with penile cancer were identified from the NSW CCR as newly diagnosed between the years of 2001 and 2009. Table 1 provides and overview of the patient characteristics. The median age was 67.5 years with 12.7% of men diagnosed younger than 50 years of age. The majority of men were born in developed countries (81.4%), lived in metropolitan cities (69.6%) and were married (61.4%). Only 30.9% of men had a Charlson co-morbidity score of one or higher indicating at least one co-morbidity.

Patterns of Care

The majority had their primary penile surgery in a public (61.4%) but non-teaching hospitals (69.1%). During the study period 129 (58.2%) were alive and 91 (41.8%) had died.

Table 2 outlines the conservative and radical penile surgical procedures undertaken (some men had more than one procedure). There was a higher, but not significant, proportion of conservative surgery undertaken in teaching hospitals (p=0.07). The stage of disease did not influence the extent of penile surgery (p=0.239) however year of surgery did, with more radical surgery occurring in the more recent years (p=0.015). In addition, higher Charlson co-morbidity was associated with more radical penile surgery (p=0.021).

Definitive penile procedures were performed in 69 centres, over the time period and ranged from 1 (26 centres) to 16 (one centre) per centre (Table 3). More than half of all the definitive penile procedures were performed at 48 centres that did <4 procedures over the 10 year period and only 1 of those was a teaching hospital. The two highest volume centres performed ≥13 procedures over the 10 year period and were both teaching hospitals.

Of men with penile cancer, a total of 53 (24%) men also had an inguinal lymph node dissection, with some being unilateral only. Table 3 provides the rates of ILND with centre volume. Over the 10 years 19/53 ILND were performed in hospitals that only did one in 10 years. Only 2 centres had a volume of greater than 7 during the time period. These centres have an ILND rate of 56% and 61%. Of the 26 hospitals (and patients) with only one penile procedure performed in 10 years, 3 received an ILND (30%). Pelvic lymph node dissection was more rare with only 12/220 (5.4%) men receiving it. Most (7) PLND were performed in hospitals where only one was performed in 10 years.

Multivariable logisitic regression analysis (Table 4) has demonstrated an association between ILND and age (OR: 0.97 95%CI 0.94-0.99), non-localised stage (OR: 3.42, 95%CI 1.76-6.66) and Charlson co-morbidity index ≥1 (OR: 2.12, 95%CI 1.00-4.51). Place of residence and teaching hospital were not significantly associated with ILND.

Survival Outcomes

The median overall survival (OS) for the 220 men in this cohort was 86.5 months and the 5 year OS 70.6%. Due to missing cause of death data relative survival and disease specific survival were unable to be calculated. Table 5

provides the 5 year OS and median OS for men with localised, regional and distant disease.

Figure 1A demonstrates OS for men with penile cancer in NSW and Figure 1B demonstrates OS categorised by stage. A significant difference in OS was identified between stages. Unknown stage demonstrated a survival outcome in between localised and regional disease. Figure 1C demonstrates the survival difference between men who were married (median OS 132months) and those who were unmarried or single (median OS 64.5months) (p=0.008). Figure 1D demonstrates the effect of co-morbidity on OS in men with penile cancer. Those with CCI=0, CC=1 and CCI>1 had a median survival of 122.5, 77.5 and 57.5months respectively (p<0.001).

The results of Cox proportional hazards analysis of factors associated with death in men with penile cancer are given in Table 6. Age (p<0.001) and co-morbidity (p=0.007) were associated with higher risk of death. Non-localised stage (HR:1.88, 95%CI 1.21-2.91) and non-married status (HR1.84, 95%CI 1.19-2.82) were also associated with higher risk of death and are factors known to be associated with premature death from penile cancer.

Treatment in low volume centres (for penile procedures) was associated with a 37% reduction in death (HR: 0.63, 95%CI0.40-0.97). Conservative verses radical penile surgery did not influence the death rate. Not having an ILND also reduced the risk of death (HR: 0.45, 95%CI 0.27-0.73).

Cox proportional hazards analysis of only men who had ILND (n=53) also showed that men treated in centres of high volume (for ILND) had a 60% reduction in risk of death (HR: 0.40, 95%CI 0.19-0.85) compared to those in centres that did only 1 ILND in the study period.

Discussion

We report for the first time, population based patterns of care and survival outcomes of men diagnosed with penile cancer in the state of NSW, Australia between 2001 and 2009 but with follow up to 2011. Our study identified that a

total of 69 centres treated penile cancer in the state, with more than half the centres performing less than four definitive penile procedures over the study period. In addition, this study is to our knowledge the first population wide study to show that centres performing <4 penile cancer surgery cases/10 years experience a 36% decrease in OS and those performing <1 ILND case over 10 years experience a 60% decrease in OS compared to low volume centres.

The majority of the 69 hospitals treating penile cancer performed one penile surgery case over the 10 year period with the median being less than 4 cases over 10 years. There were however two higher volume centres that that performed 13 and 16 penile procedures. These hospitals also acted as referral centres for ILND and performed 25 and 23 ILND cases over the 10 years. The low penile surgery volume/centre performed in NSW compares poorly with a recent publication from Matulewicz et.al. who reviewed case logs of urologists from the American Board of Urology.[11] In this study only 4.1% of urologists were found to perform penile surgery and 1.5% ILND. They also noted that the median number of penile procedures/surgeon and ILND/surgeon over a 6month period was one and one for both. In the UK prior to supra-regionalisation, the Leicester area performed seven cases a year.[12] Following regionalisation this increased to 81 surgical cases over a year.

Our study reported that 70% of penile procedures performed in NSW were radical (non-organ preserving). Interestingly those with higher co-morbidities received more aggressive treatment. This has not previously been reported and we hypothesise that this may be due to later presentation and reduced need for penile preservation in those who may not be sexually active. Interestingly, though our study also found a significant association with increasing year of surgery and increasing likelihood of receiving radical surgery. This is concerning as conservative management of the penis is extremely important for, psychological, sexual and voiding functions.[13] This study has also shown that conservative surgery for penile cancer was not associated with poorer survival (Table 6) and this has also been reported by others.[14-16]. Contrary to our findings, data from the SEER database from

USA has shown that the use of conservative penile surgery has not changed with time, however in the study by Kumar et.al, development of centralisation for penile cancer care in the UK has resulted in an increase in conservative management of the penis.[12]

Our invasive penile cancer population has a similar stage distribution to penile cancer reported from other cancer registries such as SEER[17] and from Denmark[18] with 72%-78% presenting a localised disease and 3.2% to 4.2% presenting with distant disease. The 5 year OS of 70.6% in our study compares similarly to 70% relative survival in Europe and favourably against 63% in the USA [19] although it can be noted that in some European countries the 5 year relative survival is a low as 54%.[19]

The most significant finding from our study is that centre volume was associated with OS from penile cancer. When centre volume is calculated by the number of penile cancer cases over the 10 years, survival outcomes from low volume centres were 36% lower than higher volume centres. When the analysis was limited to ILND centre volume a 60% decease in survival was observed. Although the reliability of registry data from NSW with overall survival as the outcome is of high level, this finding does need to be clarified in other jurisdictions.

The centres volumes were dichotomised around the median. A limitation for this approach meant we had low numbers of cases in both the low volume (<4) and higher volume (≥ 4) in comparison to volumes from international centres of excellence.[20] While this is true, of the higher volume centres, 2 centres performed a large proportion of the penile surgery and ILND (Table 3) and had approximately the same numbers of cases as another tertiary referral centre in Queensland, Australia[21]. As a survival difference was identified between low and high volume penile and ILND surgery in this study, we hypothesise that with centralisation of penile cancer management in NSW, this difference would be even more pronounced and could lead to a major improvement in survival for men with penile cancer. As the average incidence of penile cancer cases in NSW is approximately 28/year we would suggest that only one or 2 centres should perform this surgery in line with the NICE guidelines.[7]

Inguinal lymph node dissection has been shown to be associated with an increased risk of death in this study, however we believe that this is due to the fact that those having ILND have substantially worse disease that is not captured on the crude cancer registry staging and therefore we were unable to fully adjust for it in the models. A total of 53 (24%) men had ILND of the total 220 with penile cancer. This is substantially lower than the study by Hegarty et.al. who reported a 58% ILND rate in their series of 100 patients, however Hegarty's study does have a similar ILND rate to that seen in the higher volume centres [22]. The overall ILND rate in NSW is similar to that reported by Mautelwicz et.al who found a 27% rate of ILND in community centres in the USA.[11] Our study reported that the likelihood of ILND decreased with age but increased with stage. This has been corroborated by a study from the SEER database, that have also reported that rates of ILND have increased over time.[23] In this study we combined excisional lymph node biopsy (sentinel node biopsy) with full inguinal node dissection and so the full therapeutic effect of ILND may be obscured. In a study from the Netherlands, the rate of full ILND fell after the introduction of dynamic sentinal lymphnode biopsy (DSLNB) but survival still increased highlighting a potential method for improving management in these men.[24]

Other factors that were associated with improved survival in men with penile cancer included being married. This is a well studied phenomenon in penile cancer and has been previously reported.[17] It may be that men who are married or in a *defacto* relationship have their penile lesion identified earlier and present for medical care earlier. As expected, increasing age and co-morbidity also affected overall survival.

This study's strength is that it is population based and collected every diagnosed penile cancer in the state during the study period. The results are generalizable to the whole state, and, as approximately one-third of all Australians live in NSW, probably Australia as a whole. Being population-based and, not just academic centres, where most outcomes studies originate means a fully representative sample has been used. In addition, every inpatient admission is recorded through high-quality data linkage resulting in reliable levels of surgical treatment ascertainment.

This study however, does have limitations that may bias the results. The first, potential inaccuracy in the staging of patients in this study, as the accuracy of staging information collected cannot be confirmed. Secondly, the cancer registry does not code cancers using the TNM system so the status of regional lymph nodes cannot be accurately ascertained. Thirdly, we were unable to obtain detailed penile specimen and lymph node pathological information, which would have been useful to allow in-depth analysis of quality of surgery. Fourthly, although we have shown increased mortality in low volume centres, we do not have definitive proof that this is due to better management of penile cancer but may be due to other factors such as referral bias and case selection. Finally due to the cause of death data only being available till 2007 we did not calculate disease specific and relative survival, which would have allowed better comparisons with other published studies.

In conclusion, there is decreased use of conservative penile surgery in recent times and the median centre volume for treatment of penile cancer in NSW is fewer than four over ten years. A significant benefit in overall survival is observed in men being treated in centres with more than 4 compared to less than 4 cases over 10 years.

References

[1] Visser O, Adolfsson J, Rossi S, et al. Incidence and survival of rare urogenital cancers in Europe. Eur J Cancer. 2012 Mar: **48**:456-64

[2] Dillner J, von Krogh G, Horenblas S, Meijer CJ. Etiology of squamous cell carcinoma of the penis. Scand J Urol Nephrol Suppl. 2000:189-93

[3] Madsen BS, van den Brule AJ, Jensen HL, Wohlfahrt J, Frisch M. Risk factors for squamous cell carcinoma of the penis--population-based case-control study in Denmark. Cancer Epidemiol Biomarkers Prev. 2008 Oct: **17**:2683-91

[4] Larke NL, Thomas SL, dos Santos Silva I, Weiss HA. Male circumcision and penile cancer: a systematic review and meta-analysis. Cancer Causes Control. 2011 Aug: **22**:1097-110

[5] Alemany L, Cubilla A, Halec G, et al. Role of Human Papillomavirus in Penile Carcinomas Worldwide. Eur Urol. 2016 Jan 4:

[6] Sewell J, Ranasinghe W, De Silva D, et al. Trends in penile cancer: a comparative study between Australia, England and Wales, and the US. Springerplus. 2015: **4**:420

[7] Excellence NIfC. Improving Outcomes in Urological Cancers. 2002 [cited 2016 April 2016]; Available from:

[8] EA T, S C, D B, J B, P J. Cancer in New South Wales. Incidence and Mortality 2004. Sydney: Cancer Institute NSW; 2006

[9] Care DoHaA, Adelaide. atUo. Measuring Remoteness: accesSibility/ Remoteness Index of Australia (ARIA). Canberra: Commonwealth of Australia; 1999

[10] Esteban D WS, Laudico A, Parkin D, . Coding. In Esteban D WS, Laudico A, Parkin D, ed, Manual for Cancer Registry Personnel: IARC Technical Report No 10 Chapt 4. Lyon International Agency for Research on Cancer, 1995:4.32

[11] Matulewicz RS, Flum AS, Helenowski I, et al. Centralization of Penile Cancer Management in the United States: A Combined Analysis of the American Board of Urology and National Cancer Data Base. Urology. 2016 Apr: **90**:82-8

[12] Kumar P, Singh S, Goddard JC, Terry TR, Summerton DJ. The development of a supraregional network for the management of penile cancer. Ann R Coll Surg Engl. 2012 Apr: **94**:204-9

[13] Scarberry K, Angermeier KW, Montague D, Campbell S, Wood HM. Outcomes for Organ-Preserving Surgery for Penile Cancer. Sex Med. 2015 Jun: **3**:62-6

[14] Lont AP, Gallee MP, Meinhardt W, van Tinteren H, Horenblas S. Penis conserving treatment for T1 and T2 penile carcinoma: clinical implications of a local recurrence. J Urol. 2006 Aug: **176**:575-80; discussion 80

[15] Philippou P, Shabbir M, Malone P, et al. Conservative surgery for squamous cell carcinoma of the penis: resection margins and long-term oncological control. J Urol. 2012 Sep: **188**:803-8

[16] Djajadiningrat RS, van Werkhoven E, Meinhardt W, et al. Penile sparing surgery for penile cancer-does it affect survival? J Urol. 2014 Jul: **192**:120-5

[17] Rippentrop JM, Joslyn SA, Konety BR. Squamous cell carcinoma of the penis: evaluation of data from the surveillance, epidemiology, and end results program. Cancer. 2004 Sep 15: **101**:1357-63

[18] Baldur-Felskov B, Hannibal CG, Munk C, Kjaer SK. Increased incidence of penile cancer and high-grade penile intraepithelial neoplasia in Denmark 1978-2008: a nationwide population-based study. Cancer Causes Control. 2012 Feb: **23**:273-80

[19] Verhoeven RH, Janssen-Heijnen ML, Saum KU, et al. Population-based survival of penile cancer patients in Europe and the United States of America: no improvement since 1990. Eur J Cancer. 2013 Apr: **49**:1414-21

[20] Gopman JM, Djajadiningrat RS, Baumgarten AS, et al. Predicting postoperative complications of inguinal lymph node dissection for penile cancer in an international multicentre cohort. BJU Int. 2015 Aug: **116**:196-201

[21] Chung E, Yang S, White L, Wood S, Nicol D. Lessons learnt in the management of primary invasive penile cancer in an Australian tertiary referral centre: clinical outcomes with a minimum 48 months follow-up study. Korean J Urol. 2015 Feb: **56**:125-30

[22] Hegarty PK, Kayes O, Freeman A, Christopher N, Ralph DJ, Minhas S. A prospective study of 100 cases of penile cancer managed according to European Association of Urology guidelines. BJU Int. 2006 Sep: **98**:526-31

[23] Thuret R, Sun M, Lughezzani G, et al. A contemporary population-based assessment of the rate of lymph node dissection for penile carcinoma. Ann Surg Oncol. 2011 Feb: **18**:439-46

[24] Djajadiningrat RS, Graafland NM, van Werkhoven E, et al. Contemporary management of regional nodes in penile cancer-improvement of survival? J Urol. 2014 Jan: **191**:68-73

Figure Legend

Figure 1. Kaplan-Meier curves for overall survival in men with penile cancer (A) and stratified by Stage (B), Marital status (C) and Charlson co-morbidity index (D).

Table 1

Patient Characteristics

	Total (%)
Number	**220**
Age	
<50	28 (12.7)
50-59	34 (15.5)
60-69	64 (28.2)
70-79	58 (25.9)
80+	39 (17.7)
Median	67.5
Mean	66.4
Country of birth	
Developed	179 (81.4)
Developing	41 (18.6)
Area of residence (ARIA)	
Major cities	153 (69.6)
Other	67 (30.5)
Stage	
Localised	140 (63.6)
Regional	36 (16.4)
Distant	6 (2.7)
Unknown	38 (17.3)
Marital status*	
Married (incl. de facto)	135 (61.4)
Unmarried, single, divorced, widowed	85 (38.6)
Co-morbidity	
0	152 (69.1)
1	33 (15.0)
2+	35 (15.9)
Cause of death	
Alive	129 (58.2)
Dead	91 (41.8)

Hospital type	
Public	135 (61.4)
Private	85 (38.6)
Teaching Hospital	
Teaching	68 (30.9)
Non-teaching	152 (69.1)
Centre Volume (penile procedures)	
≥4	103 (46.8)
<4	117 (53.2)

Table 2

Conservative verses Radical Penile surgery

Factor	Conservative	Radical	Total	p-value
Hospital Type				
Teaching	50 (34.9)	93 (65.1)	143	0.07
Non-teaching	75 (26.6)	207 (73.4)	282	
Stage				0.239
Localised	48 (34.3)	92 (65.7)	140	
Metastatic (nodes or distant)	35 (42.2)	48 (51.8)	83	
Year of surgery				
2000-03	26 (37.7)	43 (62.3)	69	0.015
2004-07	45 (45.5)	54 (54.5)	99	
2008-11	12 (21.8)	43 (78.2)	55	
Co-morbidity (CCI)				0.021
0	65 (42.2)	89 (57.8)	154	
≥1	18 (26.1)	51 (73.9)	69	

Table 4

Predictors for Receiving ILND: Multivariable Analysis

Factor	OR	95% CI	P-value
Age (per year)	0.97	0.94-0.99	0.019
Stage			<0.001
Localised	1.00		
Non-localised	3.42	1.76-6.66	
Geography			0.240
Metropolitan	1.00		
Non-metropolitan	1.67	0.71-3.93	
Co-morbidity			0.05
0	1.00		
>1	2.12	0.99-4.51	
Hospital Type			0.54
Teaching	1.00		
Non-teaching	0.71	0.24-2.11	
Marital Status			0.72
Married	1.00		
Unmarried, single, divorced, widowed	0.88	0.43-1.79	

Table 5

Penile Cancer Survival

5 Year (%)	Localised	Regional	Distant	Unknown	Overall
OS	77.9%	58.2%	16.7%	64.1%	70.6%
Median (months)					
OS	122.5	63.5	8	77.5	86.5

Table 6

Factors influencing death in men with penile cancer.

All 220 patients with penile cancer						
	Univariate			Multivariate		
Factor	HR	95% CI	p	HR	95% CI	p
Age			<0.001			<0.001
<60 years	1.00			1.00		
60-69	0.91	0.47-1.73		1.01	0.52-1.99	
70+	2.61	1.53-4.44		2.82	1.57-5.04	
Stage			0.005			0.005
Localised	1.00			1.00		
Non-localised	1.83	1.20-2.74		1.88	1.21-2.91	
Marital status			0.006			0.006
Married	1.00			1.00		
Unmarried, single, divorced, widowed	1.79	1.18-2.71		1.84	1.19-2.82	
Charlson Co-morbidity			0.001			0.007
0						
1+	1.00			1.00		
	1.99	1.31-3.01		1.53	0.96-2.45	
Penile surgery			0.490			0.295
Conservative	1.00			1.00		
Radical	0.86	0.55-1.33		1.29	0.80-2.07	
Inguinal Lymph node dissection			<0.001			0.001
Yes	1.00			1.00		
No	0.47	0.31-0.73		0.45	0.27-0.73	
Centre Volume (Penile)			0.155			0.036
≤4	1.00			1.00		
>4	0.74	0.49-1.12		0.63	0.40-0.97	
Men with Inguinal Lymph Node Dissection Only						
Age			0.579			0.616
<60 years	1.00			1.00		

60-69	1.50	0.64-3.53		1.66	0.60	
70+	1.48	0.64-3.53		1.26	0.48	
Stage			0.063			0.096
Localised	1.00			1.00		
Non-localised	2.03	0.96-4.27		1.91	0.89-4.09	
Marital status			0.076			0.017
Married	1.00			1.00		
Unmarried, single, divorced, widowed	1.87	0.94-3.72		2.73	1.20-6.23	
Co-morbidity (CCI)			0.077			0.206
0	1.00			1.00		
1+	1.87	0.94-3.72		1.66	0.76-3.64	
Centre Volume (ILND)			0.149			0.017
≤1	1.00			1.00		
>1	0.60	0.30-1.20		0.40	0.19-0.85	