Cystectomy for bladder cancer in Denmark during the 2006-2013 period

Per Bagi[1], Cecilie Bagi Nordsten[1] & Henrik Kehlet[2]

ABSTRACT

INTRODUCTION: The treatment of bladder cancer has been centralised in Denmark, and only five departments are licensed to perform radical cystectomy (RC). The purpose of this nationwide study was to evaluate perioperative mortality, length of post-operative hospital stay (LOS) and readmissions related to time course, surgical technique and number of RCs performed.

METHODS: Patients were identified from the Danish National Hospital Register. We included all patients who had a RC performed because of bladder cancer in the period 2006-2013.

RESULTS: A total of 1,857 RCs were performed, 81% of which were open and 19% were robot-assisted operations. Median LOS ranged 8-15 days, with the minimum LOS at the end of period. Readmission within 30 days occurred in 35% of patients. For patients operated with open technique, the readmission rate was 32% versus 45% for robot-assisted surgery. The 30-day mortality was 1.3% of which 1.5% occurred after open and 0.6% after robot-assisted RC.

CONCLUSIONS: The study shows an increase in the number of RCs performed and a decrease in LOS during the study period. Furthermore, the study reveals a significant uptake of robot-assisted RC without obvious demonstrable benefits in terms of LOS and readmissions, but with a slightly lower mortality. Selection criteria for robot-assisted RC as well as data on tumour stage and preoperative co-morbidities are not available; therefore, interdepartmental comparison is not possible. However, these nationwide data suggest room for improvement through integration of the fast-track methodology combined with optimisation of surgical technique.

FUNDING: none.

TRIAL REGISTRATION: not relevant.

Radical cystectomy (RC) with pelvic lymph node dissection is the most effective single treatment of localised muscle-invasive bladder cancer [1, 2]. RC is a major surgical procedure and should therefore be offered only to patients in relatively good general condition and without serious co-morbidities [1-3]. However, despite careful selection of patients who are found to be suitable for RC, the risk of serious complications remains high.

Improvements in surgical technique, anaesthesia and peri- and post-operative management (the fast-track concept) have significantly reduced morbidity and mortality [1, 4] and concurrently new treatment principles have been developed. Therefore, patients previously found unsuitable for surgery may now be offered RC. Also, during recent years a rapid increase in the use of minimally invasive surgery, mainly robot-assisted surgery, has been observed. Finally, based on an active decision from the Danish Health and Medicines Authority, the treatment of bladder cancer has now become centralised, and only five departments are authorised to perform cystectomy in Denmark, in a population of five million citizens.

The purpose of this nationwide study was to evaluate perioperative mortality, length of post-operative hospital stay (LOS) and readmissions in relation to time course, surgical technique and the number of cystectomies performed.

METHODS

Patients were identified from the Danish National Hospital Register and the Danish Civil Registration System. Included were all patients above the age of 15 year, who had a cystectomy performed due to bladder cancer during the eight-year period 2006-2013. Data were collected separately for each year from the hospitals of Aalborg, Aarhus, Odense, Herlev and from Rigshospitalet. The following data were collected; perioperative mortality (death within 30 days after operation), LOS (days from operation until discharge), readmissions (within 30 days after operation) and LOS during readmission. Only readmissions with a minimum of one overnight stay were included. Binomial data (mortality and readmissions) are given as numbers, frequency and 95% confidence limits. Continuous data (LOS) are given as medians.

Trial registration: not relevant.

RESULTS

A total of 1,857 RCs were performed in the five departments during the observation period; 1,509 (81%) of these were open operations and 348 (19%) were robot-assisted laparoscopic operations (**Table 1**). Median LOS after RC in the individual departments and year ranged 8-15 days, and the minimum LOS was recorded at the

ORIGINAL ARTICLE

1) Department of Urology, Rigshospitalet
2) Section for Surgical Pathophysiology, Rigshospitalet, Denmark

Dan Med J 2016;63(4):A5217

end of the period (**Table 2**). Readmissions within 30 days occurred in 35% of patients, of which 32% occurred after open operation and 43% after robot-assisted RC (**Table 3**). Median LOS during readmissions ranged 2-25 days for the individual departments and years. Overall, the perioperative mortality after RC was 1.3%, of which 1.5% occurred after open RC and 0.6% after robot-assisted RC (**Table 4**). Variation in perioperative mortality between years ranged 0.5-2.3%, and variation between departments ranged 0.6-3.4% but with much variation in each department's mortality from one year to the next.

TABLE 1

Number of radical cystectomies, all, open and robot-assisted.

Radical cystectomy	2006	2007	2008	2009	2010	2011	2012	2013	Total
All									
Rigshospitalet	53	61	59	70	62	65	68	77	515
Herlev	39	40	34	20	37	40	46	43	299
Odense	17	14	35	39	38	37	61	53	294
Aarhus	56	37	65	69	90	87	97	79	580
Aalborg	17	21	20	20	19	23	27	22	169
Total	182	173	213	218	246	252	299	274	1,857
Open									
Rigshospitalet	53	61	59	70	62	65	63	58	491
Herlev	39	40	34	7	5	3	4	2	134
Odense	17	14	35	39	38	37	51	20	251
Aarhus	56	37	65	69	83	67	75	56	508
Aalborg	17	21	20	20	18	11	13	5	125
Total	182	173	213	205	206	183	206	141	1,509
Robot-assisted									
Rigshospitalet	0	0	0	0	0	0	5	19	24
Herlev	0	0	0	13	32	37	42	41	165
Odense	0	0	0	0	0	0	10	33	43
Aarhus	0	0	0	0	7	20	22	23	72
Aalborg	0	0	0	0	1	12	14	17	44
Total	0	0	0	13	40	69	93	133	348

TABLE 2

Post-operative length of stay for all, open and robot-assisted radical cystectomies. The values are days, median.

Radical cystectomy	2006	2007	2008	2009	2010	2011	2012	2013
All								
Rigshospitalet	11	10	10	10	10	9	10	9
Herlev	14	11	14	19.5	16	13.5	10	10
Odense	18	16	14	13	12	13	10	9
Aarhus	12	12	11	10	10	9	9	9
Aalborg	15	15	15	13.5	12	12	8	8
Open								
Rigshospitalet	11	10	10	10	10	9	10	10
Herlev	14	11	14	23	28	32	12.5	26
Odense	18	16	14	13	12	13	10	9
Aarhus	12	12	11	10	10	9	9	9
Aalborg	15	15	15	13.5	12	12	10	9
Robot-assisted								
Rigshospitalet	–	–	–	–	–	–	9	8
Herlev	–	–	–	15	15.5	13	10	10
Odense	–	–	–	–	–	–	8.5	10
Aarhus	–	–	–	–	10	8	8	10
Aalborg	–	–	–	–	12	14.5	8	8

DISCUSSION

Approximately 1,700 patients are diagnosed with a bladder tumour annually in Denmark. The number has remained relatively stable during the past ten years, yet a decline in incidence rate during recent years, suggests that bladder cancers may be becoming less common [5]. At the time of diagnosis, about half of the tumours are invasive, and half of these are also muscle-invasive cancers [1, 2]. A previous study showed that the number of RCs performed in Denmark was 153 in 2000 [6]. In the present study, we observed an increase to 274 in 2013. Thus, the proportion of patients with muscle-invasive cancer undergoing RC has almost doubled from approximately one third to two thirds [2, 6]. The reason for this increase cannot be inferred from the present data, but increased awareness in both the primary and the hospital sector about the importance of prompt treatment of bladder cancer together with new treatment approaches may have been of importance [3, 4, 7]. Also, preoperative chemotherapy may allow for downstaging of patients previously deemed inoperable, thus allowing them to undergo surgery. In addition, optimised perioperative treatment and care means that even complex surgical procedures are possible with reduced morbidity and mortality [3, 4, 8, 9]. Finally, recent and important political and organisational initiatives, including legislation with focus on prompt treatment, introduction of national fast-track cancer evaluation flow sheets, and a centralisation of treatment controlled by the Danish Health and Medicines Authority, may all have contributed to producing the demonstrated changes over time.

The LOS after RC has traditionally been long. Thus, LOS in recent European studies was approximately two weeks [6, 8, 10], while American studies often report shorter LOS [3, 11]. Local traditions for organisation and individual rules for discharge and discharge location may influence these differences [11, 12]. However, application of the multimodal principles of fast-track surgery seems to allow for a significant shortening of LOS [3, 6, 8, 10, 11]. Overall, a trend towards a shorter LOS has been evident since the mid 1990s as also found in the present study, showing a decrease in LOS from 14 to nine days which, in fact, was a continuation of the development demonstrated in a former Danish nationwide study of RC in period 2000-2005 [6]. As yet, no general agreement exists as to which well-defined discharge criteria should be applied to individual patients following cystectomy, and LOS results are highly influenced by lo-

cal tradition in individual departments, and should be interpreted cautiously. Until 2009, the operative technique was always "classic" open; but in 2009, robot-assisted laparoscopic RC was introduced in Denmark and now, after four years, about half of the RCs are performed with this minimally invasive technique. However, this change is not reflected in LOS, morbidity or readmission, which show no difference according to technique, a fact which seems to be in accordance with recent randomised evidence, showing similar rates of perioperative complications and LOS following open and robot-assisted laparoscopic RC [13]. However, there is a need for studies combining the minimally invasive technique with the fast-track methodology.

Overall, the perioperative mortality was 1.3%. It varied between 0.5 and 2.3% over the years. There were no systematic changes through the eight-year observation period. Mortality in each individual department and year ranged 0-8.8; however, absolute numbers are low, and even small changes in numbers will therefore have major impact on the results. These results are in good agreement with international studies, mostly reporting mortality rates up to 4.5% in unselected series. The variation in the literature, however, is significant, giving mortality rates of 0-9%, with the highest mortality rates found in elderly patients [2, 6, 8, 9, 10, 14-17]. The lower mortality with robot-assisted RC may be real or due to selection bias, but this cannot be answered from the present data.

The reported readmission rate after RC is high [3, 10, 11, 18, 19]. In the present study, a third of the patients were readmitted within 30 after surgery – even though patients without overnight stay were excluded. Owing to the method of data collection, i.e. drawing on data from central health authorities, all readmissions were included, not only from the operating hospital but also from all other hospitals in Denmark, a fact which has increased the readmission rate compared with other studies as approximately one fifth of the readmitted patients were hospitalised at 'other hospitals'. The LOS during readmissions was not negligible with the median LOS ranging 2-25 days. The data do not allow for detailed analysis of the reasons for readmissions, and as no consensus exists on which patients are to be readmitted, readmission data may be highly influenced by local practise. A local audit performed at Rigshospitalet in 2012 showed that 20 (29%) patients were readmitted within 30 days. Of this group, nine (45%) were admitted for catheter problems, three (15%) for infection (including urosepsis), two (10%) for abdominal pain, one (5%) for wound dehiscence, one (5%) for bleeding haemorrhoids and one (5%) for bowel paralysis. In three (15%) cases, a percutaneous intervention for ureteric stenosis or lymphocele was performed, but without further surgery.

TABLE 3

Readmissions within 30 days for all, open and robot-assisted radical cystectomies. The values are n (% [95% confidence limits]).

Radical cystectomy	2006	2007	2008	2009	2010	2011	2012	2013	Total
All									
Rigshospitalet	21 (40 [27-54])	25 (41 [29-54])	16 (27 [16-40])	25 (36 [25-48])	18 (29 [18-42])	17 (26 [16-39])	20 (29 [19-42])	29 (38 [27-49])	171 (33 [29-38])
Herlev	27 (69 [52-83])	32 (80 [64-91])	16 (47 [30-65])	9 (45 [23-69])	18 (49 [32-66])	20 (50 [24-66])	26 (57 [41-71])	21 (49 [33-65])	169 (57 [51-62])
Odense	3 (17 [4-43])	2 (14 [2-43])	3 (9 [2-23])	12 (31 [17-47])	12 (32 [18-49])	5 (14 [5-29])	12 (20 [11-32])	19 (36 [23-50])	69 (23 [19-29])
Aarhus	9 (16 [8-28])	15 (41 [25-58])	25 (38 [27-51])	24 (35 [24-47])	43 (48 [37-59])	38 (44 [33-55])	29 (30 [21-40])	21 (27 [17-38])	205 (35 [32-39])
Aalborg	7 (41 [18-67])	1 (5 [0-24])	3 (15 [5-36])	2 (10 [1-32])	7 (37 [16-62])	4 (17 [5-39])	4 (15 [4-34])	1 (5 [0-23])	29 (17 [12-24])
Total	67 (37 [30-44])	75 (43 [36-51])	63 (29 [24-36])	72 (33 [27-40])	99 (40 [34-47])	84 (33 [28-40])	91 (31 [25-36])	92 (34 [28-40])	643 (35 [33-37])
Open									
Rigshospitalet	21 (40 [27-54])	25 (41 [29-54])	16 (27 [16-40])	25 (36 [25-48])	18 (29 [18-42])	17 (26 [16-39])	19 (30 [19-43])	22 (38 [26-52])	163 (33 [29-38])
Herlev	27 (69 [52-83])	32 (80 [64-91])	16 (47 [30-65])	7 (54 [4-71])	1 (20 [1-72])	0 (0 [0-71])	4 (100 [40-100])	0 (0 [0-84])	82 (61 [52-70])
Odense	3 (17 [4-43])	2 (14 [2-43])	3 (9 [2-23])	12 (31 [17-47])	12 (32 [18-49])	5 (14 [5-29])	9 (18 [8-31])	4 (20 [6-44])	51 (20 [16-26])
Aarhus	9 (16 [8-28])	15 (41 [25-58])	25 (38 [27-51])	24 (35 [24-47])	38 (46 [35-57])	25 (37 [26-50])	20 (27 [17-38])	15 (27 [16-40])	171 (34 [30-38])
Aalborg	7 (41 [18-67])	1 (5 [0-24])	3 (15 [5-36])	2 (10 [1-32])	6 (33 [13-59])	1 (9 [0-41])	0 (0 [0-25])	0 (0 [0-52])	20 (16 [10-24])
Total	67 (37 [30-44])	75 (43 [36-51])	63 (29 [24-36])	72 (33 [27-40])	75 (37 [30-43])	48 (26 [20-33])	52 (25 [20-32])	41 (29 [22-37])	487 (32 [30-35])
Robot-assisted									
Rigshospitalet	–	–	–	–	–	–	1 (20 [1-72])	6 (32 [13-57])	7 (30 [13-51])
Herlev	–	–	–	7 (54 [25-81])	17 (53 [35-71])	20 (54 [19-42])	21 (50 [34-66])	21 (51 [35-67])	86 (52 [44-60])
Odense	–	–	–	–	–	–	3 (30) (7-65)	15 (46) (28-64)	18 (42) (27-58)
Aarhus	–	–	–	–	5 (71 [29-96])	11 (55 [32-77])	9 (41 [21-64])	6 (26 [10-48])	31 (43 [31-55])
Aalborg	–	–	–	–	1 (100 [3-100])	3 (25 [6-57])	4 (29 [8-54])	1 (6 [0-29])	9 (20 [10-35])
Total	–	–	–	7 (54)	23 (57 [41-73])	34 (49 [37-62])	38 (41 [31-52])	49 (37 [29-46])	151 (43 [38-49])

TABLE 4

Perioperative mortality after all, open and robot-assisted radical cystectomies. The values are n (% [95% confidence limits]).

Radical cystectomy	2006	2007	2008	2009	2010	2011	2012	2013	Total
All									
Rigshospitalet	0 (0 [0-6.7])	1 (1.6 [0-8.8])	1 (1.7 [0.1-9.1])	0 (0 [0-5.1])	2 (3.2 [0.4-11])	0 (0 [0-5.5])	0 (0 [0-5.3])	0 (0 [0-4.7])	4 (0.8 [0.2-2.0])
Herlev	0 (0 [0-9.0])	0 (0 [0-8.8])	1 (2.9 [0.1-15])	0 (0 [0-17])	1 (2.7 [0.1-14])	0 (0 [0-8.8])	1 (2.2 [0.1-12])	0 (0 [0-8.2])	3 (1.0 [0.2-2.9])
Odense	1 (5.9 [0.1-29])	1 (7.1 [0.2-3.4])	3 (8.8 [1.8-23])	1 (2.6 [0.1-14])	1 (2.6 [0.1-14])	1 (2.7 [0.1-14])	1 (1.6 [0-8.8])	1 (1.9 [0-10])	10 (3.4 [1.6-6.2])
Aarhus	0 (0 [0-6.4])	0 (0 [0-9.5])	0 (0 [0-5.5])	2 (2.9 [0.4-10])	0 (0 [0-4])	0 (0 [0-4.2])	4 (4.1 [1.1-10])	1 (1.3 [0-6.9])	7 (1.2 [0.5-2.5])
Aalborg	0 (0 [0-20])	0 (0 [0-16.1])	0 (0 [0-17])	0 (0 [0-17])	0 (0 [0-18])	1 (4.3 [0.1-22])	0 (0 [0-13])	0 (0 [0-15])	1 (0.6 [0-3.4])
Total	1 (0.5 [0-3.0])	2 (1.2 [0.1-4.1])	5 (2.3 [0.8-5.4])	3 (1.4 [0.3-4.0])	4 (1.6 [0.4-4.1])	2 (0.8 [0.1-2.8])	6 (2 [0.7-4.3])	2 (0.7 [0.1-2.6])	25 (1.3 [0.9-2.0])
Open									
Rigshospitalet	0 (0 [0-6.7])	1 (1.6 [0-8.8])	1 (1.7 [0.1-9.1])	0 (0 [0-5.1])	2 (3.2 [0.4-11])	0 (0 [0-5.5])	0 (0 [0-5.7])	0 (0 [0-6.2])	4 (0.8 [0.2-2.1])
Herlev	0 (0 [0-9.0])	0 (0 [0-8.8])	1 (2.9 [0.1-15])	0 (0 [0-41])	0 (0 [0-52])	0 (0 [0-71])	0 (0 [0-60])	0 (0 [0-84])	1 (0.7 [0-4.1])
Odense	1 (5.9 [0.1-29])	1 (7.1 [0.2-3.4])	3 (8.8 [1.8-23])	1 (2.6 [0.1-14])	1 (2.6 [0.1-14])	1 (2.7 [0.1-14])	1 (2.0 [0-10])	1 (5.0 [0.1-25])	10 (4.0 [1.9-7.2])
Aarhus	0 (0 [0-6.4])	0 (0 [0-9.5])	0 (0 [0-5.5])	2 (2.9 [0.4-10])	0 (0 [0-4.3])	0 (0 [0-5.4])	4 (5.3 [2.1-13])	1 (1.8 [0-9.6])	7 (1.4 [0.6-2.8])
Aalborg	0 (0 [0-20])	0 (0 [0-16.1])	0 (0 [0-17])	0 (0 [0-17])	0 (0 [0-19])	1 (9.1 [0.2-41])	0 (0 [0-25])	0 (0 [0-52])	1 (0.8 [0-4.4])
Total	1 (0.5 [0-3.0])	2 (1.2 [0.1-4.1])	5 (2.3 [0.8-5.4])	3 (1.4 [0.3-4.0])	3 (1.5 [0-4.4])	2 (1.1 [0.1-3.9])	5 (2.4 [0.8-5.6])	2 (1.4 [0.2-5.0])	23 (1.5 [0.1-2.3])
Robot-assisted									
Rigshospitalet	-	-	-	-	-	-	0 (0 [0-52])	0 (0 [0-18])	0 (0 [0-14])
Herlev	-	-	-	0 (0 [0-24])	1 (3.1 [0.1-16])	0 (0 [0-9.5])	1 (2.4 [0.1-13])	0 (0 [0-8.6])	2 (1.2 [0.1-4.3])
Odense	-	-	-	-	-	-	0 (0 [0-31])	0 (0 [0-1]1)	0 (0 [0-8.2])
Aarhus	-	-	-	-	0 (0 [0-41])	0 (0 [0-17])	0 (0 [0-15])	0 (0 [0-15])	0 (0 [0-5.0])
Aalborg	-	-	-	-	0 (0 [0-98])	0 (0 [0-27])	0 (0 [0-23])	0 (0 [0-20])	0 (0 [0-8.0])
Total	-	-	-	-	1 (2.5 [0.1-13])	-	1 (1.1 [0-5.8])	0 (0 [0-2.7])	2 (0.6 [0.1-2.1])

Although a centralisation of RC has occurred over the past decade in Denmark, the small numbers performed annually in each department and differences in the implementation of minimally invasive surgery obstruct a more detailed analysis of outcomes between departments. This applies both to LOS, readmissions and mortality. The question that remains to be answered is whether there is a need for further centralisation with even fewer departments. This may be appropriate to improve the experience level and achieve an exact outcome analysis, but may also be expedient in view of the expensive introduction of robot-assisted RC which has not currently translated into a definitely improved outcome [13, 18, 20].

The limitations of the present study are mainly that data were obtained from the Danish National Hospital Register based on a simple anonymised database search and with a focus on year and hospital. A number of items are therefore not considered, including complications (except for mortality), reasons for readmissions, urinary diversion type and whether performed intra- or extracorporally when using robot, tumour stage and co-morbidity. Also, collecting data from central registries always implies a risk that data are incomplete. However, in the study by Johansen et al [6], an agreement of 99% was found between surgical procedure and discharge summary, and an audit at Rigshospitalet for the eight-year study period showed a 99.6% agreement between data from a local database and data from the National Patient Register (NPR). These findings are in contrast to a recent study by Jerlstrom et al [10] who presented Swedish results based on a national population-based database, which only included 66% of the relevant patients. Thus, a strength of the present data are the national data and complete data on LOS, readmissions and mortality, since almost all operations and hospitalisations are registered in the NPR.

CONCLUSIONS

Although a number of factors which might affect the perioperative course were not collected such as tumour stage, discharge type and preoperative co-morbidities, the overall data suggest that there is room for improvement, including through further implementation of the fast-track methodology and an urgent need to demonstrate that the robot-assisted technique has a potential for better outcomes – as we do not currently have evidence to support this.

CORRESPONDENCE: *Per Bagi*. E-mail: per.bagi@regionh.dk

ACCEPTED: 9 February 2016

CONFLICTS OF INTEREST: Disclosure forms provided by the authors are available with the full text of this article at www.danmedj.dk

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