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Quality Assessment of Cataract Surgery in Denmark

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Abstract

Background: To assess the quality of cataract surgery in Denmark by studying the epidemiology of cataract surgery in Denmark during the last decade and by examining the risks of pseudophakic retinal detachment (PRD) and postoperative endophthalmitis (PE).

Methods: A ph.d. thesis based on four register- and chart based studies.

Results: It was found that over a 10 year calendar period a cataract operation increased the risk of PRD by a factor 4.2. Age and sex were statistically significant risk factors for retinal detachment but the effect of cataract surgery on the risk of retinal detachment per se was not statistically significantly modified by age and sex. The risk of PE at public eye departments was about 4 per 10000 registered cataract operations. A few private clinics had a statistically significantly higher risk of PE following registered cataract surgery compared to public eye departments. Out of 121 cases of PE, a complication after surgical intervention for PE occurred in 27% of all cases. Overall, a vitreous tap was not associated with a statistically significantly higher risk of surgical complications compared to a pars plana vitrectomy. Patients who underwent cataract surgery in private clinics were operated at an increasingly younger age and were healthier compared to patients who underwent cataract surgery in public hospitals. In general, there was a lack of registration of cataract surgery by the private clinics.

Conclusions: The risks of PRD and PE can be used as quantitative indicators of the quality of cataract surgery in Denmark, but the lack of registration of cataract surgery by private clinics limits the quality of the Danish cataract registries. A more complete registration of cataract surgery in Denmark will make it easier to assess and monitor the quality of cataract surgery in the future.

Keywords: Cataract surgery; Retinal detachment; Endophthalmitis; Quality; Private; Public

Introduction

The purpose of this paper is to summarize the main findings of a recent Ph.D. thesis [1] which consists of four main papers. The main findings of this thesis have previously been reported [1]. The primary aim of the thesis was to assess the quality of cataract surgery in Denmark by assessing various epidemiological aspects of cataract surgery in Denmark during the last decade and by studying the risks of two of the most serious complications to cataract surgery; pseudophakic retinal detachment (PRD) and postoperative endophthalmitis (PE).

In modern health care there is a growing demand for quality assessment and how to measure efforts to improve quality. Cataract surgery is one of the most commonly performed surgical procedures worldwide and therefore a lot of research is carried out in order to reduce postoperative complications. In Denmark, eye departments in public hospitals and private clinics perform an increasing number of cataract operations each year but at the same time it is required that they maintain a high quality of the operations for the benefit of the patients.

One way to monitor and assess quality in healthcare is to use an indicator which is a variable that can be easily measured and is a direct measure of quality. A quality indicator provides a quantitative basis to assess aspects of the structure, process or outcome of health care. For instance, the risks of postoperative complications following cataract surgery such as PRD and PE can be used as indicators of the quality of the operations. These are rare complications to cataract surgery but if they occur they are registered in the Danish National Patient Registry (NPR). The NPR is a very comprehensive registry which covers the entire country and it provides detailed information for each surgical procedure performed in Denmark such as the date of surgery, which eye that underwent surgery and the personal identity number of the patient. These rare complications are however not necessarily the most optimal quality indicators of cataract surgery. Other and possibly better indicators could be patient satisfaction outcomes, visual outcomes or refractive outcomes but these indicators are not registered in the NPR and therefore these data can be more difficult to assess and quantify.

Registration of cataract surgery in Denmark has been mandatory for all public eye departments since 1995 and in 2004 registration of cataract surgery was also made obligatory for private clinics in Denmark. There are 3 cataract registries in Denmark and the majority of the operations are registered in the NPR. The NPR can be used to identify all cataract operations that have been performed during a given study period. All surgeries for PRD and PE in Denmark are performed at public eye departments, but there is ambiguity in the coding of PE.

Methods

The research was approved by the Danish Data Protection Agency (journal number:2012-41-1285) and the local ethics committee (journal number: H-2-2011-004). The three Danish cataract registries were used as data sources in the thesis. Cataract surgery was defined by the surgical code KCJE20-phacoemulsification cataract surgery. Surgeries for rhegmatogenous retinal detachment (RD) were defined as described by Hajari et al. [2]. In order to identify all cases of endophthalmitis in this thesis a broad search for PE was performed in the NPR (Table 1).

	Diagnosis codes	Surgical codes
Search strategy number 1	DH440 (purulent endophthalmitis)	
	DH441 (other kind of endophthalmitis)	
	DH451 (endophthalmitis with a disease classified elsewhere)	
	DH598B (postoperative endophthalmitis)	
Search strategy number 2		A KCKD65 (vitrectomy through pars plana or pars plicata) procedure 120 days after a KCJE20 procedure
Search strategy number 3	DH20 (inflammation in the iris or ciliary body)	In combination with any of the following:
	DH200 (acute or subacute iridocyclitis)	KCKA10 (vitreous biopsy)
	DH201 (chronic iridocyclitis)	KCKD05 (puncture of the vitreous with injection of medicine)
	DH202 (iridocyclitis lentica)	KCKD65 (vitrectomy through pars plana or pars plicata)
	DH208 (other kind of iridocyclitis)	KTCK20 (needle biopsy of the vitreous)
	DH209 (iridocyclitis without any specification)	KCWC00 (reoperation due to a profound infection after an operation on an eye or eye surroundings)
	DH30 (inflammation in the choroid or retina)	
	DH300 (focal chorioretinis)	
	DH301 (disseminated chorioretinis)	
	DH302 (posterior cyclitis)	
	DH308 (other kind of chorioretinis)	
	DH309 (chorioretinis without any specification)	
	DT814X (other postoperative infection)	
	DT857 (infection or inflammation of any other internal prosthesis, implant or transplant)	
	DT899 (nosocomial infection)	
Search strategy number 4	DZ961 (a condition with an intraocular lens)	In combination with any of the following:
		KCKD60 (anterior vitrectomy)
		KCKD65

Table 1: Search strategies for the identification of PE cases in the NPR.

Results

In paper I [3] a total of 220,226 patients who all underwent seemingly uncomplicated cataract surgery over a 10 year calendar period in Denmark were studied. We found that the risk of PRD is different when fellow eyes are used as reference compared to when the background population is used as reference. The risk of RD in cataract operated eyes was equal to the risk of RD in fellow non-operated eyes multiplied by a factor (the PRD risk ratio) caused by the operation. The PRD risk ratio was about 9 in the first 6 months after surgery and gradually declined to about 3 where it remained up to 10 years after surgery. The crude PRD risk ratio was 4.2 and did not differ statistically significantly between sexes or age groups. This means that over a 10 year calendar period a cataract operation increases the risk of PRD by a factor 4.2 irrespective of sex and age. Young men had the highest absolute risk of PRD because they had a higher risk of RD before they underwent cataract surgery.

In paper II [4] a total of 112 PE cases were identified by using the search strategy as outlined in Table 1. It was found that the PE risk at

the 7 public eye departments was 0.36 per 1000 registered cataract operations and the PE risk was homogeneous among the public eye departments. The PE risk at the 28 private clinics was 0.73 per 1000 registered cataract operations, but the PE risk among the private clinics was heterogeneous. The majority of the private clinics had a risk of PE that was lower than or the same as the risk of PE at the public eye departments following registered cataract surgery. However, six private clinics had a statistically significantly higher PE risk compared to the public eye departments following registered surgery. Overall, the risk of PE after cataract surgery in private clinics was statistically significantly higher than the PE risk among public eye departments. We found a decrease in the PE risk after cataract surgery during the nine year study period although this was not statistically significant. At the public eye departments, the PE risk was reduced from 0.5 per 1000 operations in the years 2002-2004 to 0.3 per 1000 operations in the years 2008-2010. Finally, the study revealed that the mandatory NPR registration of cataract surgery performed in private hospitals/clinics was incomplete.

In paper III [5], the risks of five surgical complications to surgical intervention for PE were studied: RD, surgery for vitreous opacities, removal of the IOL (intraocular lens), additional surgery for PE and removal of the eye. It was found that a complication after surgical intervention for PE occurred in 27.3% of all PE cases and one in ten PE cases developed more than one complication. There was no statistically significant difference in the risk of RD (p=0.45), surgery for PE (p=0.22), IOL removal (p=0.19) or removal of the eye (p=0.69) between the cases that underwent a pars plana vitrectomy (PPV) and the cases that underwent a vitreous tap (VT), but PE cases that underwent a VT had a statistically significantly higher risk of surgery for vitreous opacities compared to a PPV (p=0.047). Overall, we could not show that PE cases that underwent a VT had a statistically significantly higher risk of complications compared to a PPV.

As outlined in paper II, many cataract operations performed in private clinics were not registered in the NPR. This lack of registration is one of the reasons why it is difficult to get an overview of the number of cataract operations in Denmark. Another reason is it that the operations are registered in 3 different registries. For this reason we wanted to investigate how many of the non-NPR registered cataract operations performed in private clinics that were registered in the other two registries in the study period 2004-2012. Paper IV [6] showed that the number of cataract operations in Denmark increased by 40% during the study period. This was primarily caused by a 92% increase in the number of registered cataract operations performed in private clinics whereas the number of registered cataract operations performed in public eye departments increased by about 21%.

The sex ratio changed during the study period with a statistically significant decrease in the proportion of first eye cataract operated patients who were female from 63% in 2004 to 58% in 2012. It was found that 46% of the cataract operations performed in private clinics that led to cases of PE were not registered in any of the 3 registries. For this reason, the correct number of cataract operations performed in private clinics in Denmark might be almost twice the number of registered operations.

The mortality in patients who had cataract surgery in public hospitals was 62% higher compared to patients who had cataract surgery in private clinics. We also found a statistically significant increase in the mortality inequality between patients who had cataract surgery in public hospitals and patients who had cataract surgery in private clinics during the study period. Men had a statistically significantly higher mortality than women and the mortality increased statistically significantly with decreasing age.

There was a major decrease in the median time interval between first and second eye cataract surgery during the study period both for cataract operations in public hospitals and private clinics. The median time interval between first and second eye cataract surgery was significantly shorter at private clinics compared to public hospitals during the entire study period. Also, the mean age at first eye cataract surgery decreased statistically significantly during the study period. The decrease in the mean age at first eye cataract surgery for patients operated in private clinics was statistically significantly greater compared to the decrease in the mean age at first eye cataract surgery in patients operated in public hospitals.

Discussion

By using the fellow non-operated eyes of the patients as reference a novel study design was implemented to study the risk of PRD in paper I. Other studies on PRD have also shown that young men have the highest risk of PRD [7-15], but these studies did not investigate the isolated effect of cataract surgery on the risk of PRD. We do not know why there is a difference in the epidemiology of RD in the fellow eyes in our study compared to eyes in the general population. The patients in our study all had surgically demanding cataract on one eye whereas this is not so in the general population, which might explain the difference.

A PRD can be used as an indicator of surgical quality because the risk of PRD increases if the cataract operation is complicated by e.g. capsular rupture. The results of this paper emphasize that young men should be informed of the increased of risk of PRD when they consider e.g. a clear lens extraction or have a vitrectomy procedure which leads to cataract.

The risk of PE after phacoemulsification cataract surgery in Denmark has not been studied before. Within recent years a large volume of cataract operations in Denmark have been outsourced to private clinics due to a change in Danish health legislation in 2002, but it has not been studied if this was associated with an increased risk of PE. It was beyond the scope of this paper to investigate why cataract surgery at a few private clinics seemed to be associated with an increased risk of PE. In line with other studies [16-18] we found a decrease in the PE risk after cataract surgery during the nine year study period although this was not statistically significant. At the public eye departments, the PE risk was reduced by 25% per 3-year calendar period from 0.5 per 1000 operations in 2002-2004 to 0.3 per 1000 operations in 2008-2010. The same sector specific analyses could not be performed for the private hospitals/clinics because not all private hospitals/clinics had registered cataract surgery in all three 3-year calendar periods.

In 2004, new legislation was implemented in order to increase the registration of cataract surgery in private hospitals/clinics to the NPR [19]. However, when we looked at the fraction of non-registered cataract operations based on backtracking cases of PE, the registrations did not improve during the study period. Therefore, the real volume of cataract surgery in private hospitals/clinics might be more than twice as high as the volume that is registered in the NPR. In all, the risk of PE is a good quantitative quality indicator of cataract surgery.

The risk of complications in paper III was similar to or higher than the risk found in the landmark Endophthalmitis Vitrectomy Study

(EVS) [20] even though the EVS was conducted in the early 1990's and new and better vitrectomy techniques have been developed since then. In fact, the most serious complication-removal of the eye-was seen in 7.4% of the PE cases in our study compared to only 0.5% of the cases in the EVS. In many ways, our study is in line with the findings of the EVS and does not support the recommendations of the recent European Society of Cataract and Refractive Surgeons (ESCRS) guidelines [21]. A PPV does provide a larger sample for microbiological examination but when we compared a PPV with a VT we found that there was no statistically significant difference in the number of culture-positive PE cases from the vitreous between the two groups indicating that it does not seem that important. It seems rational that a PPV removes more pus from the vitreous compared to a VT, but we could not find a statistically significant difference in the number of culture-positive recultured PE cases between the two groups. In conclusion, the surgical complications studied in this paper seem to be reliable indicators of the quality of primary surgical intervention for PE.

Paper IV was an attempt to obtain and combine information on cataract surgery from all 3 cataract registries in Denmark in order to get an overview of the number of cataract operations that are performed in Denmark. Furthermore, we wanted to study the epidemiology of cataract surgery in Denmark. Almost 50% of the cataract operations performed in private hospitals/clinics that led to cases of PE in this study were not registered in any registry. For this reason, the correct number of cataract operations performed in private hospitals/clinics in Denmark might be almost twice the number of registered operations. The results of paper IV suggest that patients who had cataract surgery in private clinics in general were healthier than patients who had cataract surgery in public hospitals and that this health difference became more pronounced during the study period. Also, the study showed that both public hospitals and private clinics progressively reduced the time interval between cataract surgeries in the two eyes during the study period. Furthermore, it seemed as if there was a change in the epidemiology of cataract operations during the study period so private clinics performed cataract surgery in patients who were increasingly younger compared to patients who had cataract surgery in public hospitals.

One of the limitations of this thesis is that all the studies are retrospective and are based on registry data. Although the quality of the registry data is excellent there are potential errors inherent in using registry data. Also, the lack of registration of cataract surgery by private hospitals/clinics makes the registries incomplete.

In conclusion, registry data has the potential to assist in the quality assessment of cataract surgery in Denmark. Complications such as PRD and PE can be used as indicators in order to quantify the surgical quality of cataract surgery. Denmark has unique and very comprehensive registry data on cataract surgery and ocular surgery in general. If the registration of cataract surgery becomes more comprehensive, the Danish cataract registries can be effective and inexpensive tools to assess and monitor the quality of cataract surgery in Denmark. This could potentially lead to fewer postoperative complications in the future.

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