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Original Research Article

An observational study to compare Muhtaseb's and Habib's scoring systems in patients undergoing phacoemulsification to predict risk in cataract at a tertiary centre in West Bengal

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ABSTRACT

Background: Cataract is derived from the Latin 'cataracta', meaning 'waterfall' as rapidly running water turns white, so term may have been used metaphorically to describe similar appearance of mature ocular opacities.[1]
Methods: This observational study with prospective study design has been conducted in the college of medicine and JNM hospital, department of ophthalmology, COMJNMH, Kalyani-741235, Nadia District, West Bengal which catering mostly the rural and also urban population. The study was done spread over a period of 18 months starting from July 2018 to December 2019, i.e., 1 year for research and 6 months for analysis. It included all patients, irrespective of age, undergoing Phacoemulsification surgery for cataract admitted in our hospital fulfilling the laid criteria for the study.
Results: The study consisted of total 147 cases in these 14 (9.52%) cases complicated with PCR, 10 (6.80%) striate keratopathy and 4 (2.72%) cases complicated with both PCR and striate keratopathy. Though sample size derived was 126 cases, 147 cases were studied during the research period of 1 year. Out of 10.89% cases of miscellaneous risk (ex: poor position of the eye/patient) risk factor, posterior capsule rupture (12.5%), striate keratopathy (12.5%), cases having both complication (00.0%) and total complicated cases (25%) which is 1.36%, 1.36%, 0% and 2.72% of total cases respectively. Out of 8.84% cases of unable to lie flat risk factor, posterior capsule rupture (15.38%), striate keratopathy (7.69%), and total complicated cases (23.07%) which is 1.36%, 0.68% and 2.04% of total cases respectively.
Conclusions: The current study tries to validate two scoring systems to predict complications during phacoemulsification surgerylike risk of posterior capsule rupture and striate keratopathy and to predict the potential difficulty of a case.

Keywords: Snellen's chart, Posterior capsular rupture, Posterior polar cataract

INTRODUCTION

Cataract is derived from the Latin 'cataracta', meaning 'waterfall' as rapidly running water turns white, so the term may have been used metaphorically to describe the similar appearance of mature ocular opacities.[1]

Cataract is the leading cause of preventable blindness in the world. Globally, cataracts cause moderate to severe disability in 53.8 million (2004) people, 52.2 million of whom are in low- and middle-income countries.[1] Age-related cataract are responsible for 51% of world blindness, about 20 million people. The WHO/NPCB (National program for control of blindness) survey has shown that there is a backlog of over 22 million blind eyes (12 million blind people) in India, and 80.1% of these are blind due to cataract.[1,2]

Cataract surgery is one of the most frequently performed surgeries today. Contemporary cataract extraction has good success in terms of visual acuity and visual function improvement. However, any surgery has potential risks and complications that may affect the post operative outcome. Intracapsular cataract extraction (ICCE) is rarely performed at present.[2] Extracapsular cataract extraction (ECCE) consists of removing the lens manually, but leaving most of the capsule intact.[3] Manual small incision cataract surgery (MSICS) has evolved from conventional ECCE. In MSICS, the lens is removed through a self-sealing sclera corneal tunnel.[4]

Phacoemulsification has become the procedure of choice for cataract surgery.[5] Phacoemulsification is a type of ECCE in which the crystalline lens is emulsified with an ultrasonic handpiece and aspirated from the eye.

Charles Kelman introduced phacoemulsification in 1967 after being inspired by his dentist's ultrasonic probe.[6] In phacoemulsification unintended trauma may occur to various structures like the cornea, iris, zonules, lens capsule etc. Use of ultrasound in phacoemulsification can cause effects such as corneal oedema, and macular oedema after surgery. Among these, a rupture of the posterior capsule is one of the most dreaded complications since it can lead to a series of the other events finally resulting in a poor visual outcome for the patient.[6]

Corneal oedema is a less serious but more common post operative cataract surgery complication and occur because of persistent swelling at the front of the eye. Pseudophakic bullous keratopathy presents as long-standing corneal oedema.[7,8]

Hence the necessity of knowledge regarding prevention and management of complications associated with this surgery cannot be over emphasized. During surgery these two complications posterior capsular rupture and striate keratopathy (corneal oedema) draw attention for study. Prediction of probability of a complication during phacoemulsification till now has been based on a preoperative subjective evaluation of the patient by the operating surgeon.[9]

The reasons why an objective system to ascertain the likelihood of complications during surgery is as such[10]: Trainee surgeons would be able to select appropriately cases for phacoemulsification so that cases with lower risk can be operated by them as well as the patients undergoing proposed surgery can be apprised aptly about the predicted risk and results of the differing case mixes of the various surgeons could be compared appropriately.

There are a number of reasons to attempt risk stratification in cataract surgery[10]: This will allow meaningful preoperative counselling of patients. This will allow teaching centers to assign low-risk cases to the novice surgeons, and higher risk cases can be assigned to advanced trained surgeons. Each surgeon can then assess his case results against a standard benchmark. This will allow review of steps needed to conform to the benchmark, by either seeking more training or referring more complex cases to higher centers. This permits meaningful comparison of data between individual surgeons and hospitals with differing case mix.

Two systems-Muhtaseb's scoring system and Habib's scoring system- have been devised for the prediction of complication in phacoemulsification surgery-Muhtaseb et al Moorfields eye hospital and Habib et al Sunderland eye infirmary.[11,12] This study is an attempt to compare the two scoring systems to predict the risk of posterior capsule rupture and striate keratopathy in phacoemulsification surgery and to predict the potential difficulty of a case.

METHODS

This observational study with prospective study design has been conducted in the college of medicine and JNM hospital, department of ophthalmology, COMJNMH, Kalyani-741235, Nadia District, West Bengal which catering mostly the rural and also urban population. The study was done spread over a period of 18 months starting from July 2018 to December 2019, i.e., 1 year for research as well as six months for analysis. It included all patients, irrespective of age, undergoing phacoemulsification surgery for the cataract admitted in our hospital fulfilling the laid criteria for the study.

Inclusion criteria

All cataract patients admitted in the department, undergoing phacoemulsification surgery were included in the study.

Exclusion criteria

Patients with combined procedures, complicated cataract, traumatic cataract, lens induced glaucoma and those with pre-existing ocular pathology significantly impairing central vision other than cataract were all excluded.

Ethical committee clearance

The clearance from the institutional ethics committee (IEC) of the college of medicine and JNM hospital, WBUHS, Kalyani had been taken prior to initiation of the study. The participants had been told in detail about the study. Written informed consent had been taken from the participants before shifting to operation theatre. The participants are free to opt out of the study at any time they feel like. The confidentiality of the study participants had been maintained and no personal identifying data will be collected. The study has been approved by institute ethics committee vide letter number CM-JNM-2018-135.

Sample size

Based on various studies, prevalence of cataract was estimated to be 0.8%. Final sample size is 126 which is calculated based on formula.

$(1.96)^2$ p×q/ e^2 where p=0.8% and e=7%, (q=1-p).

Study duration

The study conducted from March 2018 to December 2019.i.e 1 year for research and 6 months for analysis.

Statistical analysis

The data collected entered in MS excel 2016 expressed sheet and analysis conducted out. The statistical analysis done in IBM SPSS® software, version 22.0 (SPSS Inc., Chicago, IL, USA). Properties of parameter presented as percentage and Pearson's chi-square test were used in this study to analyze variables. P=0.05 or less will be considered as statistically significant.

Table 1: Point allocation for risk factors by Muhtaseb and Habib in their scoring systems.

Risk factor	Score allocated	
	Muhtaseb's scoring system	Habib's scoring system
Miscellaneous risk assessed by the surgeon (e.g., poor position of eye/ patient)	1	–
Unable to lie flat (spinal deformity, asthma, heart failure)	—	1
Severe anxiety	—	1
Head tremor	—	1
Previous angle closure glaucoma	—	1
History of complication in fellow eye	—	1
Previous vitrectomy	1	1
Corneal scarring/ cloudiness	1	1
Shallow anterior chamber	1	1
Poor pupillary dilation and/or posterior synechiae	1	1
Pseudo exfoliation	3	1
Phacodonesis /weak zonules	3	1
High ametropia (>6 D myopia or hyperopia)	1	–
High myopia (axial length >27 mm)	–	1
High hypermetropia (axial length <20 mm)	–	1
Age >88 years	1	–
Nuclear density grade 1-2	–	1
Nuclear density grade 3	–	2
Mature/brunescent/white/dense/total cataract	3	3
Posterior capsule plaque	1	–
Posterior polar cataract	1	–

Slit lamp examination on the first post-operative day for striate keratopathy: All patients attending the eye OPD on the two scheduled OPD day of the surgeon, underwent visual acuity testing by Snellen's chart, and refractive error testing by auto kerato-refractometer.

Patients with axial length more than 27 mm/ less than 20 mm (normal range considered for study) is noted, then patients counselled for cataract surgery by Phacoemulsification method and following points are noted by general physical exam, personal history: Poor position of eye, like sunken globe/ elevated nasal bridge, patients' inability to lie flat (spinal deformity/ huge matted hair/ asthma), head tremor and severe anxiety.

All above procedure will be done by same investigator and scoring will be done using both scoring systems.

Number of cases which landed up in PCR, noted during phacoemulsification. On the first post-operative day, slit lamp examination of every patient has been done both by operating surgeon and principal investigator and presence of striate keratopathy has been noted.

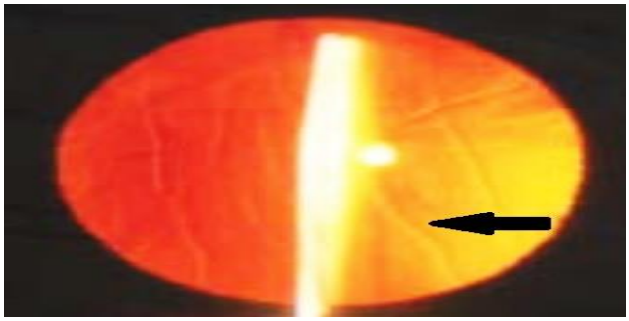

Figure 1: Slit lamp examination-black arrow indicating striate keratopathy.

RESULTS

The study consisted of total 147 cases in these 14 (9.52%) cases complicated with PCR, 10 (6.80%) striate keratopathy and4 (2.72%) cases complicated with both PCR and striate keratopathy. Though sample size derived was 126 cases, 147 cases were studied during the research period of 1 year.

Out of 10.89% cases of miscellaneous risk (ex: poor position of the eye/patient) risk factor, posterior capsule rupture (12.5%), striate keratopathy (12.5%), cases having both complication (0%) and total complicated cases (25%) which is 1.36%, 1.36%, 0% and 2.72% of total cases respectively.

Out of 8.84% cases of unable to lie flat risk factor, posterior capsule rupture (15.38%), striate keratopathy (7.69%), and total complicated cases (23.07%) which is 1.36%, 0.68% and 2.04% of total cases respectively.

Out of 6.8% cases of severe anxiety as a risk, posterior capsule rupture (50%), striate keratopathy (10%), cases having both complication (10%) and total complicated cases (50%) which is 3.4%, 0.68%, 0.68% and 3.4% of total cases respectively.

Out of 8.16% cases with head tremor, posterior capsule rupture (41.6%), striate keratopathy (58.3%), cases having both complication (25%) and total complicated cases (75%) which is 3.4%, 4.7%, 2.04% and 6.12% of total cases respectively.

Out of 4.76% cases of previous angle closure glaucoma as a risk factor, posterior capsule rupture (57.14%), striate keratopathy (28.57%), cases having both complication (28.57%) and total complicated cases (57.14%) which is 2.72%,1.36%,1.36% and 2.72% of total cases respectively.

Out of 4.76% cases with h/o complication in fellow eye, posterior capsule rupture (28.57%), striate keratopathy (28.57%), cases having both complication (14.28%) and total complicated cases (42.85%) which is 1.36%, 1.36%, 0.68% and 2.04% of total cases respectively.

No complication observed in 1.36% case of previous vitrectomy (risk).

Out of 8.84% cases of corneal scarring / cloud risk keratopathy (40%) and total complicated cases (40%).

Out of 18.36% cases with shallow anterior chamber, posterior capsule rupture (18.5%), striate keratopathy (18.5%), cases having both complication (11.11%) and total complicated case is (25.9%) which is 3.4%, 3.4%, 2.04% and 4.76% of total cases respectively.

Out of 13.6% cases with poor papillary dilation and or posterior synechiae as risk factor, posterior capsule rupture (20%), striate keratopathy (30%), cases having both complication (15%) and total complicated cases (35%) which is 2.7%, 4.08%, 2.04% and 4.76% of total cases respectively.

Out of 3.4% cases with pseudo exfoliation, posterior capsule rupture (40%), and total complicated cases (40%) respectively.

Out of 4.08% cases of phacodonesis/weak zonules as risk, posterior capsule rupture (66.6%), striate keratopathy (16.6%), cases having both complication (16.6%) and total complicated case is (66.6%) which is 2.72%, 0.68%, 0.68% and 2.72% of total cases respectively.

No complications observed in 2.04% cases with high ametropia (6 D Myopia or hyperopia) (Table 2).

The 2.72 % cases in the study had high myopia (Table 3).

The 2.04% cases had high hypermetropia (Table 4).

Habib's scoring done in 147cases (Table 5).

Table 2: High ametropia (6 D Myopia or hyperopia).

Risk factor	No. of cases	Complications in those with high ametropia				
			PCR	Striate keratopathy	Cases with both complication	Total case
High ametropia (6 D myopia or hyperopia)	3	No. of cases	0	0	0	0
		% risk factor	0	0	0	0
Total (%)	2.04	0	0	0	0	0

Table 3: High myopia (Axial length > 27 mm).

Risk factor	No. of cases	Complications in those with high myopia				
			PCR	Striate keratopathy	Cases with both complication	Total case
High myopia (Axial length >27 mm)	4	No. of cases	1	2	1	2
		% risk factor	25	50	25	50
Total (%)	2.72		0.68	1.36	0.68	1.36

Table 4: High hypermetropia (Axial length<20 mm).

Risk factor	No. of cases	Complications in those with high myopia				
High hypermetropia (Axial length <20 mm)	3		**PCR**	**Striate keratopathy**	**Cases with both complication**	**Total case**
		No. of cases	2	2	2	2
		% Risk factor	66.66	66.66	66.66	66.66
Total (%)	2.04		1.36	1.36	1.36	1.36

Table 5: Habib's score and percentage of complications observed.

Score	No. of cases	PCR	Striate keratopathy	Cases with both complications	Total cases with both complications	Percentage (%)
00	01	0	0	0	0	0
01	25	0	0	0	0	0
02	56	2	0	0	2	3.57
03	30	1	1	0	2	6.66
04	14	3	1	0	4	28.57
05	9	3	2	1	4	44.45
06	8	2	3	0	5	62.5
07	4	3	3	3	3	75

Table 6: Muhtaseb's score and percentage of complications observed.

Score	No. of cases	PCR	Striate keratopathy	Cases with both complications	Total cases with both complications	Percentage (%)
00	13	0	0	0	0	0
01	62	4	3	1	6	9.6
02	29	2	0	0	2	6.89
03	20	0	0	0	0	0
04	09	2	1	0	3	33.3
05	08	4	4	3	5	62.5
06	03	0	2	0	2	66
07	03	2	0	0	2	66

Muhtaseb's scoring done in 147 cases (Table 6).

DISCUSSION

The present study is to compare the two-scoring system for preoperative risk assessment for the patient's undergoing phacoemulsification-Muhtaseb's scoring system and Habib's scoring system.

The current study comprises of 147 cases conducted in college of medicine and JNM hospital, department of ophthalmology, Kalyani, West Bengal. [The WHO/NPCB (National program for control of blindness) survey has shown that there is a backlog of over 22 million blind eyes (12 million blind people) in India, and 80.1% of these are blind due to cataract. The annual incidence of cataract blindness is about 3.8 million].

The result of observation is analyzed in tabular form and compared with the available studies to bring out the similarities and dissimilarities in different aspect.

Preston H Blomquist et al in his study of the cases performed by 33 residents, 1833 met the inclusion criteria. There were 120 complications (6.5%), Tarbet et al reported a rate of 5.3% of PCR in his study. In a retrospective analysis of 396 patients, Corey et al reported an incidence of 1.8% of complications by residents. Lee et al found intraoperative complications in 21.7% of resident cases and Rutar et al in 9.7%.[13-17]

Chakrabarti et al studied that extraocular risk factors are usually associated with difficult access to surgical field due to physical limitations and/or limited visibility of operative field. This includes deep set eyes with prominent brow, exaggerated bells phenomenon resulted in complications. Narendran et al in his audit of 55,567 operations in the United Kingdom found a significant association of posterior capsule rupture and inability to lie flat.[18,19]

Chakrabarti et al studied those corneal opacities (pterygium, extensive arcus senilis, scar and band keratopathy) usually associated with difficult access to surgical field due to limited visibility of operative field.[18]

Chakrabrati et al in his study observed that the patients with shallow anterior as a risk, posterior capsule is closer

to phaco-needle and thus at increased risk of PCR.[18] Risk of intraoperative complications increases in inadequate mydriasis thus rendering irrigation/aspiration, phacoemulsification and capsulorrhexis difficult as it limits visibility. For PCRan important risk factor is intraoperative miosis. Intraoperative miosis was the commonest reason to convert phacoemulsification to extracapsular cataract surgery as per the study by Dada et al.[20-22]

There is no consensus available on high ametropia (6 D myopia or hyperopia) as a risk for the development of complications in phacoemulsification. In some cases, due to floppy and large capsular bag, increased anterior chamber depth, and zonular weakness, surgery of cataract in myopic eyes becomes challenging.[23]

In study by Zuberbuhler it has been reported that with high axial length intraoperative complications are not expressively amplified.[24]

Contradictorily Fesharaki et al in their study reported that with every 1.0 mm increase in axial length complications increased 1.22 times.[25] It was reported in Haigis study that for axial length > 27.0 mm, posterior capsule tear incidence was 2.3-9.3%.[26] Zonular weakness predisposes to this condition. High myopia is also a well-known risk factor for vitreous loss.[27,28] In study done by Waldmann et al reported that patients with high hyperopia often have ocular comorbidities.[29] Such eyes may be surgically challenging, resulting in reduced benefits from cataract surgery compared to normal eyes.

In past different studies has been conducted taking age as a risk factor for PCR in phacoemulsification. Narendran et al confirmed a steady rise in complication rate with increasing patient age.[19] Berler noted a variation in complication rate with age, with an increase in rates of PCR over the age of 88 years.[30]

Blomquist et al in his study showed dense nuclear sclerosis significant risk factors in the risk score associated with intraoperative complications (odds ratio [or], 2.08; 95% confidence interval [ci], 1.32-3.26; p=0.004).[13] Narendran et al in cataract national dataset electronic multicenter audit of 55, 567 operations in the United Kingdom found a significant association of posterior capsule rupture and, brunescent /white cataract.[19]

Some authors have reported valuable advice in their study like Chakrabarti et al reported in their study hydro-dissection is not recommended in white mature cataracts.[31] Singh et al observed, in brunescent and black cataracts the lens fibers are cohesive thus making division difficult.[32,10]

Previous studies have indicated that the presence of posterior polar cataract alone is associated with a 26-40% risk of posterior capsule rupture during phacoemulsification surgery. Posterior polar cataract (PPC) is at a higher risk for developing PCR.[33,34] The incidence of posterior capsule rupture during removal of PPC is reported to be as high as 36% and surgery is of higher risk when there is an associated pre-existing posterior capsule defect.[35,36] They considered that this is a major contributing factor to complications and that cases of posterior polar cataract should be given greater significance in any risk calculation.

Current study consists of total 147 cases in these 14 (9.52%) cases complicated with PCR, 10 (6.80%) striate keratopathies. In this study, cases of miscellaneous risk factor (e.g., poor position of the eye/patient), total complicated case is 25%. For cases unable to lie flat (risk factor), total complicated case is 23.07% which is 2.04% of total cases. In cases of severe anxiety as a risk total complicated case is 50%. In cases of previous angle closure glaucoma as a risk factor total complicated case is 57.14%. In cases with the history of complication in fellow eye total complicated case is 42.85%. cases of corneal scarring /cloudiness as risk, total complicated case is 40%, which is accordance with the previous study. With shallow anterior chamber as risk-total complicated case is 25.9%. In poor pupillary dilation and/or posterior synechiae total complicated case is 35%. Pseudo-exfoliation, total complicated case is 40% and correlating with Lumme et al and Humayun study.[37-39] In this study, cases of phacodonesis /weak zonules as risk, total complicated case is 66.6%. No complications observed in cases with high ametropia (6 D myopia or hyperopia) as a risk. It is observed that 50% of cases having high myopia as a risk, developed complication hence showing significant co-relation with Fesharaki et al study.[25]

Cases with high hypermetropia (axial length <20 mm), observed total complication is (66.66%). Age > 88 as risk factor years significantly influenced the incidence of PCR and striate keratopathy in phacoemulsification and showing significant co relation with Narendran et al, Berler, Mohammad Zare et al in their studies.[19,30,37] Incases of nuclear density grade-3 as risk, total complicated case is (13.33%) and with nuclear density grade 1-2 total complicated case is (8.10%), showing co-relation with Preston H Blomquist et al in their study.[13] In the current study cases with mature / brunescent / white / dense/ total cataract, total complicated case is (19.35%) in co-relation with previous study done by Narendran et al.[19] In cases of posterior capsule plaque total complicated case is (5.06%) hence in co-relation with GennadaLanda et al study.[40]

In current study cases of posterior polar cataract as risk, total complicated case is (60%) and showing significant co-relation with Vasavada et al and Osher et al study.[33,34]

Future work is required to establish the significance of individual risk factors by a more objective means, and allocate an appropriately weighted score for each risk

factors accordingly. This, however, will require a very large-scale study.

Blomquist et al concluded his study with the opinion:[13] 1) Beginning surgeons should be given cases with a risk score of less than 7. 2) Surgeons with less experience have significantly higher rates of posterior capsule rupture than more experienced surgeons.

Osborne et al in their study recommended usage of a scoring system pre-operatively for selection of cases appropriately for the trainee surgeons and also case difficulty prediction of phacoemulsification surgery patient.[41] It has been implied that Habib's scoring system can very well indicate the operating surgeon possible complexity of the case and probability of a posterior capsule rupture.[35] But as a drawback it does not attribute traumatic cataracts or posterior polar cataracts as risk factors, even though these factors can be linked with a greater possibility of surgical complication.[33-35,42]

Osborne et al study opines that:[41] Cases scoring 1 with Habib's system are suitable for all trainees. Cases scoring 2 should be performed only by trainees who have performed more than 50 previous phacoemulsification and; Cases scoring 3 or more should be performed only by trainees who have performed at least 200 previous phacoemulsification or by senior grade surgeons

One remarkable thing to note is that both the discussed systems credit low score in terms of relative risk to posterior polar cataract. While Habib's system does not allocate any points to posterior polar cataract, Muhtaseb's scoring system assigns only one point. Both these systems though count zonular weakness but do not ascribe score for traumatic cataract. Traumatic cataract irrespective of zonular integrity could be linked to greater chance of posterior capsule rupture.[43] According to study by Tyson, previous complicated phacoemulsification surgery in the other eye will be associated with an increased risk of complication to the current eye.[44] This was assigned as a risk factor only by Habib et al in their scoring system. Even though with these shortcomings both these scoring systems can be used as forecasters of prospective intraoperative complication.

In this study, scoring done with both the scoring system (Muhtaseb's scoring system and Habib's scoring system). In current study Habib's scoring ranges from 00 to 19. The score is 03 or less than 03 in 112 cases and more than 03 in 35 cases. The complication increases sharply when the risk score is more than 03. Complication of risk score 03 is 6.66% and complication of risk score 04 is 28.57%.

In current study Muhtaseb's scoring ranges from 00 to 18. It is not showing a good co-relation between difficulty score of a case and complications which is undergoing during the process of phacoemulsification surgery.

Both scoring systems would appear to be useful in predicting the likelihood of a complication, although Habib's 'potential difficulty score system' appears to be more reliable predictor. Current study correlating with the study of Osborne et al invalidation of two scoring systems for the prediction of posterior capsule rupture during phacoemulsification surgery.[41]

Limitations

The limitations of the study include small sample size and mono-centric study.

CONCLUSION

The current study tries to validate two scoring systems to predict complications during phacoemulsification surgery like risk of posterior capsule rupture and striate keratopathy and to predict the potential difficulty of a case. Preoperative stratification of the cases can be done using both scores but Habib's potential difficulty score is better and appears to be a more reliable predictor showing close co-relation with percentage of complication. Both scoring systems can easily be applied in practice and are helpful in good appraisal of surgical outcomes from different surgeons. It can also aid in selection of appropriate cases for trainees and in informing the patient likelihood difficulty of the case, and the risk of complication.

Multicentre studies are required to establish the influence of individual risk factors on surgical outcome.

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