Senior resident phacoemulsification learning curve

Curva de aprendizado do residente de terceiro ano em facoemulsificação

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ABSTRACT

Purpose: To analyse the outcomes of surgeries performed by senior residents during the learning curve related to intraoperative complications and staff interventions. Methods: Prospective study of phacoemulsification surgeries performed by senior residents (3rd year) in the first three months of experience with this technique at the HC FMUSP. Intraoperative complications and requirement of staff interventions were measured. Results: 261 surgeries were included. 30 cases of intraoperative complications were noted (11.54%). Major complications, that could affect surgical final results, as posterior capsulotomy and vitreous loss, had an incidence rate of 8.05% and 6.13%, respectively. Surgery was converted to cataract extracapsular extraction in 3 cases and 2 cases required pars plana vitrectomy. Staff intervention was required in 11 cases (4.22%), most of them on the first 40 surgeries. Conclusion: With proper training and supervision, senior residents can achieve an acceptable complication rate. Adequate supervision is crucial to guarantee, good surgical outcomes, specially on the first 40 cases, that presents greater complications rates.

Keywords: Cataract extraction/education; Learning; Inservice training; Ophthalmologic surgical procedures/education; Internship and residency

INTRODUCTION

Cataract surgery is the most common surgical procedure performed around the world, which reflex the fact that cataract is the first cause of blindness in the world. Population aging is making the needs for cataract surgery raise exponentially around the world¹. Residency curriculum reflects this fact. Cataract is the core procedure for training residents. Nowadays, phacoemulsification cataract surgery has become the preferred technique, because of its safety, faster recovery and reproducibility².

There are some issues on when to start the training in phacoemulsification surgery. On the one hand, it is desirable to the surgeon to have previously experience in micro and intraocular surgery. On the other hand, up to 10% of the residents may experience troubles in developing surgical skills³ and the later the training, less the time to specially training and supervise distressed surgeons.

Learning process complications are a point of major concern, due to the concernment with patients safety⁴. The learning curve of phacoemulsification performed by residents shows a higher number of complications⁵–⁶ in the first cases, that decreases while experience increases. Thereafter, complications rates are considered acceptable, with good visual results⁷–⁹–¹⁰ in the long term.

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In the cataract surgery teaching program of the Department of Ophthalmology of Clinical Hospital of University of São Paulo School of Medicine (HC FMUSP), cataract surgery by phacoemulsification technique is performed by senior residents (3rd year), who have fairly experience in microsurgery and intraocular surgery by performing first wet labs and other procedures as part of the curriculum (at least 50 extracapsular cataract extraction and 20 pterygium excision with conjunctival autograft), besides watching more than 100 phacoemulsification procedures. This method is similar to the preferred practice pattern in resident-performed cataract surgeries of the United States residency programs.

Resident-performed cataract surgeries have a high potential for complications. Factors that can predict complications are: dense / white / mature / brunescent cataract, nuclear grading 1+, high refraction errors (eyes >27 mm or <20 mm), zonule weakness, pseudoexfoliation, posterior synechiae, shallow anterior chamber, corneal cloudiness, previous surgery, severe patient anxiety, inability to lie flat, polar posterior cataract, total capsular cataract extraction and 20 pterygium excision with conjunctival autograft, besides watching more than 100 phacoemulsification procedures. This method is similar to the preferred practice pattern in resident-performed cataract surgeries of the United States residency programs.

The aim of this study is to report the phacoemulsification learning curve of senior residents. Intraoperative complications and requirement of staff interventions were measured in the first 3 months of experience of phacoemulsification cataract surgery technique.

**METHODS**

A prospective study was conducted in the outpatient surgical room of the HC FMUSP in the 3 first months of residents phacoemulsification learning curve, between May/08 and July/08. All resident-performed cataract surgeries that did not meet any exclusion criteria: previous surgery, “special” cataracts (traumatic cataract, polar posterior cataract, total cataract, etc), another ocular disease, like glaucoma, uveitis and corneal opacities, insufficient mydriasis, eyes with orbital hardness and only eye were included.

The residents performed phacoemulsification with a relatively uniform technique in all cases. While patients were under topical or local (peribulbar block) anesthesia, residents performed clear cornea incisions. A continuous curvilinear capsulorrhexis was performed. The lens was then phacoemulsified, usually with the “stop-and-chop” technique. When possible, foldable acrylic intraocular lenses were inserted into the capsular bag.

Trained fellows registered the surgeries (from Monday to Thursday) performed by the residents. The residents changed the surgical day, according to a previous curriculum schedule. The registration included complications, resolution and requirement of intervention by the staff-attending doctor. Residents case number was established by asking each resident all phacoemulsification cases performed at all facilities chronologically and then assigning each case its sequential number. Thus, the case numbers used for analysis reflect the actual experience of the individual resident performing the surgery rather than the exact sequential order of cases performed at the institution during the study period.

The data collected are registered and analyzed in a Microsoft Excel® database.

All the patients signed the informed consent form. The Institution Investigational Review Board approved the study.

**RESULTS**

261 surgeries were eligible for the study 14 third year residents performed the operations. Table 1 shows the number of surgeries per resident surgical experience.

Table 1. Number of surgeries* per resident surgical experience in phacoemulsification at the HC FMUSP, 2008

<table>
<thead>
<tr>
<th>Surgeries* previously performed by the resident</th>
<th>Number of surgeries*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 40</td>
<td>114</td>
</tr>
<tr>
<td>41 to 80</td>
<td>95</td>
</tr>
<tr>
<td>81 and more</td>
<td>52</td>
</tr>
<tr>
<td>Total</td>
<td>261</td>
</tr>
</tbody>
</table>

* surgeries refers to phacoemulsification cataract surgeries

Table 2 shows the absolute number of complications and the relative rates at each surgical experience group. In this study, an overall complication rate of 11.54% was found.

Table 2. Frequency of complications and relative rate of complication in each group of resident surgical experience in phacoemulsification at the moment of the complication at HC FMUSP, 2008

<table>
<thead>
<tr>
<th>Surgeries* previously performed by the resident</th>
<th>Frequency of complications</th>
<th>Complication rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 40</td>
<td>14</td>
<td>12.28%</td>
</tr>
<tr>
<td>41 to 80</td>
<td>9</td>
<td>9.47%</td>
</tr>
<tr>
<td>81 and more</td>
<td>7</td>
<td>13.46%</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>11.49%</td>
</tr>
</tbody>
</table>

* surgeries refers to phacoemulsification cataract surgeries
must be satisfactorily performed to easily make the next step, eyes. At the end of the second year, the teaching of phacoemulsification is considered one of the most difficult to mastering the technique, they are authorized to make ex-

Surgical skills learning can be one of the greatest challenges of the residency training. The trainees must develop cognitive knowledge, dexterity and tridimensional appreciation of the eye anatomy. Among the eye surgeries, the phacoemulsification is considered one of the most difficult to master.

In the HC FMUSP, a progression from theoretical readings to wet labs practice and ultimate participation in surgeries is proposed. After a theoretical course of two months, the first year resident starts a preparation for microsurgery training suture in surgical gloves at the microscope. When the resident himself.

the resident must master most of the steps at the time he begins the learning of phacoemulsification cataract surgery. In the first surgeries, the resident has a full time supervision by a staff experienced cataract surgeon. It is recom-

The complication rate is accepted as a parameter that reflects the phacoemulsification learning curve. The chances of experiencing a complication decrease by 1% with each successive case during training.

Few studies show the general complication rate. Most of them points out just the vitreous loss rates. The incidence of complication in resident-performed surgeries or junior trainees ranged from 1.8% to 27.4%.[5-6,10,14-15,18] As expected, a de-

DISCUSSION

Surgical skills learning can be one of the greatest challenges of the residency training. The trainees must develop cognitive knowledge, dexterity and tridimensional appreciation of the eye anatomy. Among the eye surgeries, the phacoemulsification is considered one of the most difficult to master.

In the HC FMUSP, a progression from theoretical readings to wet labs practice and ultimate participation in surgeries is proposed. After a theoretical course of two months, the first year resident starts a preparation for microsurgery training suture in surgical gloves at the microscope. When mastering the technique, they are authorized to make extracapsular cataract extractions are performed. Throughout the year, the residents are encouraged to take some hours at the wet lab, performing some phacoemulsification surgery in pig eyes. At the end of the second year, the teaching of phacoemulsification starts. Because every step in phacoemulsification must be satisfactorily performed to easily make the next step,
CONCLUSÃO

In this study, major complications related to resident-performed phacoemulsification with previous experience in micro and intraocular surgery presented a low incidence. The training surgeons, without the need of staff major intervention managed most of complications. Adequate supervision is essential to guarantee good surgical results, specially in the first 40 cases, that presents greater complications rates.

RESUMO

Objetivo: Analisar a curva de aprendizado dos residentes do 3º ano, com experiência prévia em microcirurgia e cirurgia intraocular, em facetectomia por facoemulsificação relacionada às complicações peroperatoriais e ao número de intervenções diretas do orientador. Métodos: Foi realizada análise prospectiva de cirurgias de facetectomia por facoemulsificação realizadas durante os três primeiros meses de treinamento do residente do 3º ano do HC FMUSP nesta técnica. Foram registradas as complicações ocorridas durante o ato operatorio e a necessidade do orientador intervir diretamente na cirurgia. Resultados: Foram incluídas 261 cirurgias. Destas, tiveram algum tipo de complicaçao peroperatoria 30 cirurgias (11,54%). Complicações mais graves, com potencial para prejudicar o resultado final da cirurgia, em especial rotura de cápsula posterior e perda vitrea, tiveram um índice de 8,05% e 6,13%, respectivamente. Houve necessidade de conversão para facetectomia extracapsular em 3 cirurgias e de vitrectomia posterior em 2 casos. O orientador interveio diretamente na cirurgia em 11 ocasiões (4,22%), concentradas em sua grande maioria nas 40 primeiras cirurgias. Conclusão: Com treinamento e supervisão adequados, taxas de complicações aceitáveis podem ser obtidas por residentes sênior no aprendizado da facoemulsificação. Adequada assistência é imprescindível para garantir o resultado das cirurgias especialmente na fase em que os residentes têm maiores taxas de complicações, correspondente às 40 primeiras cirurgias.

Descritores: Extração de catarata/educação; Aprendizagem; Capacitação em serviço; Procedimentos cirúrgicos oftalmológicos/educação; Internato e residência

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