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Original article

Analysis of the vitreoretinal surgery learning curve[☆]

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ABSTRACT

Objective: To describe intra- and post-operative complications, as well as the evolution of the surgical technique in first 4 years of work of a novice retina surgeon, and evaluate minimal learning time required to reduce its complications, deciding which pathologies should still be referred to higher level hospitals, until further experience may be achieved.

Methods: A study was conducted on patients that had undergone vitreoretinal surgery by a novice surgeon in Tarragona between 23rd October 2007 and 31st December 2011. The primary diagnosis, surgeon learning time, surgical technique, intra-operative and post-operative complications were recorded.

Results: A total of 247 surgeries were studied. The percentage of use of 20G and 23G calibers during the time, marks a change toward trans-conjunctival surgery from the ninth trimester (98 surgeries). Surgical complications decreased toward twelfth trimester (130 surgeries) with an increase in the previous months.

Conclusions: The shift toward 23G technique around 100 surgeries is interpreted as greater comfort and safety by the surgeon. Increased surgical complications during the following months until its decline around 130 surgeries can be interpreted as an 'overconfidence'. It is arguable that the learning curve is slower than what the surgeon believes. An individual analysis of the complications and surgical outcomes is recommended to ascertain the status of the learning curve.

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Análisis de la curva de aprendizaje en cirugía vitreoretiniana

R E S U M E N

Palabras clave:

Curva de aprendizaje
Cirugía vitreoretiniana
Vitreotomía
Desprendimiento de retina
Hemorragia vítrea
Membrana epirretiniana
Habilidades quirúrgicas

Objetivo: Describir la evolución de las complicaciones intraoperatorias y postoperatorias, así como la evolución en la técnica quirúrgica, en los 4 primeros años de un cirujano de retina y poder evaluar el tiempo de aprendizaje necesario para reducir el número de complicaciones, objetivando aquellas patologías que debieran seguir derivándose a otros centros hasta conseguir una mayor experiencia quirúrgica.

Métodos: Se revisaron los pacientes intervenidos de cirugía retiniana por un cirujano novel en Tarragona, entre el 23 de octubre de 2007 y el 31 de diciembre de 2011. Se evaluaron el diagnóstico principal, el tiempo de aprendizaje del cirujano, la técnica quirúrgica, las complicaciones intraoperatorias y las postoperatorias.

Resultados: Se revisaron 247 cirugías. El porcentaje de uso de los calibers 20G y 23G durante el tiempo denota un cambio hacia la cirugía transconjuntival a partir del noveno trimestre (98 cirugías realizadas). Las complicaciones descienden a partir del trimestre 12 (130 cirugías), con un incremento en los meses anteriores.

Conclusiones: El cambio de tendencia hacia la técnica 23G alrededor de las 100 cirugías se interpreta como una mayor comodidad y seguridad en la cirugía. El aumento de complicaciones quirúrgicas durante los meses siguientes hasta el descenso a partir de las 130 cirugías se puede interpretar como un «exceso de confianza». Puede afirmarse que la curva de aprendizaje es más lenta de lo que el cirujano cree, siendo recomendable el análisis individual de las propias complicaciones y de la evolución quirúrgica para poder determinar en qué situación de la curva de aprendizaje se encuentra.

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Introduction

In ophthalmology, vitreoretinal surgery is characterized by making contact with highly sensitive structures that may produce irreversible consequences for vision.¹ In addition, on many occasions intra-surgery maneuvers are improvised on the basis of what is being observed, with many complications that the surgeon must foresee and know how to resolve. Accordingly, vitreoretinal surgery is regarded as having one of the longest learning curves, despite the fact that there is no standardization about the meaning of this term.^{2,3}

The “learning curve” concept was originally introduced in 1936 in the aircraft industry by TP Wright, who described a theory for evaluating repetitive assembly production of aircraft.⁴ The hypothesis was that the man-hours required for completing a production unit decrease in a constant percentage every time production doubled. In said industry, the “learning curve” is applied to production time and cost.⁵

In surgery, a “learning curve” is defined as the time and number of procedures that a surgeon requires to perform a new procedure with a reasonable result.⁶

In ophthalmology, the only recommended surgeries to be considered as learning curve are those carried out in some fellowships at internationally renowned hospitals. According to the program of the Luis Sánchez Bulnes hospital of the Association for Preventing Blindness in Mexico, the number of proposed surgeries is of 75 in one year⁷ and, according to the Fellowship of the European School for Advanced Studies in Ophthalmology (ESASO), the number increases to 150

surgeries although without differentiating between head surgeon or assistant.⁸

There is no standard for measuring learning curves in surgery with the exception of robotic urology surgery performed with the DaVinci system which mainly takes into account the study of complications.⁹

The objective of the present paper is to describe the evolution of intra-and post-surgery complications as well as the evolution of surgical techniques in the first 4 years of practice of a retina surgeon, enabling an evaluation of the approximate time required to reduce the number of complications and identify pathologies that should be referred to other hospitals in order to increase surgical experience.

Subjects, materials and methods

A review of all patients who underwent retinal surgery performed by the same surgeon at the Ophthalmology Dept. of the *Xarxa Sanitaria i Social* of Santa Tecla, Tarragona (Spain) between October 23, 2007 and December 31, 2011. The Retina Unit was started up with an entirely new team. The only previous experience of the head surgeon in vitreoretinal surgery was that of an assistant. In turn, assistant surgeons and nurses had experience in scleral surgery but no previous contact with vitrectomy.

In the beginning, the *technical means* available to the unit consisted in a 20G vitrectomy system, endocular laser, SF6, liquid perfluorocarbon (LPFC) and a set of Landers contact lenses. In December 2008, a broad field contact visualization system

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