ORIGINAL ARTICLE

Time and motion study in the preoperative phase of cataract surgery

Estudio de tiempos y movimientos en el preoperatorio de cirugía de catarata

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Abstract

Objective: *To identify, through a time and motion study, opportunities to shorten surgical deferral in cataract surgery.* **Methods:** *A non-clinical, prospective, cross-sectional, and analytical time and motion study was conducted, in which a group of experts estimated the minimum, usual, and maximum times for 12 activities in the preoperative phase of cataract surgery. Using a beta distribution, the dispersion of each activity's duration and the mean time per activity and for the entire preoperative sequence, from initial ophthalmological evaluation to surgery, were estimated.* **Results:** *The mean preoperative time for cataract surgery was 269 days; the activity with the greatest dispersion was the period between the receipt of supplies and surgery; preoperative risk studies and evaluations accounted for 40.9% of the time, and ophthalmological preoperative studies for 17.4%.* **Conclusions:** *Shortening the duration of preoperative evaluations by facilitating access to diagnostic studies could reduce the duration of the cataract surgical scheduling process by 60%.*

Keywords: *Cataract surgery. Surgical deferral. Preoperative. Time and Motion.*

Resumen

Objetivo: *Identificar, mediante un estudio de tiempos y movimientos, oportunidades para acortar el diferimiento quirúrgico en cirugía de catarata.* **Métodos:** *Se desarrolló un estudio de tiempos y movimientos, no clínico, prospectivo, transversal y analítico, en el cual un grupo de expertos estimó los tiempos mínimos, habituales y máximos para 12 actividades en el preoperatorio de cirugía de catarata. Con una distribución beta se estimaron la dispersión de la duración de cada actividad y el tiempo medio por actividad y de toda la secuencia preoperatoria, desde la valoración oftalmológica inicial hasta la cirugía.* **Resultados:** *El tiempo medio del preoperatorio de la cirugía de catarata fue 269 días; la actividad con mayor dispersión fue el lapso entre la recepción de insumos y la cirugía; los estudios y las valoraciones de riesgo preoperatorio representaron el 40.9% del tiempo, y los estudios preoperatorios oftalmológicos el 17.4%.* **Conclusiones:** *Acortar la duración de las evaluaciones preoperatorias, facilitando el acceso a estudios de diagnóstico, podría reducir un 60% la duración del proceso de programación quirúrgica de catarata.*

Palabras clave: *Cirugía de catarata. Diferimiento quirúrgico. Preoperatorio. Tiempos y Movimientos.*

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Introduction

Time and motion studies are used in Administration to identify the time consumed by activities in a process and the moments when their duration can be optimized[1]. The methodology of time and motion studies can be direct, in which external observers are assigned to the process to measure the duration of activities, or indirect, in which already performed measurements or the opinion of focus groups are used. In the medical field, time and motion studies are applied to procedures (e.g., surgery) or processes, such as sequences of activities to provide care[2].

Cataract surgery is one of the most frequently performed procedures[3], but there is still a backlog in global coverage. Barriers to care include lack of public awareness about the condition, the fact that surgeries are predominantly performed in urban areas, and the cost of the procedure.

For patients with access to cataract surgery, a limitation is the deferral that occurs in institutions; although in the private sector, the resolution of the condition takes little time, the institutional preoperative period can be long, and there is a lack of measurements to identify elements that could shorten it. Time and motion studies in cataract surgery have mainly focused on the surgical procedure[4-6]; in general, there is little information about the time required between the first ophthalmological evaluation and cataract surgery.

A time and motion study was developed to identify the activities that consume the most time in the preoperative phase of cataract surgery and to identify those whose duration could be shortened in the institutional setting, with the aim of reducing surgical deferral.

Methods

An observational, prospective, cross-sectional, analytical, non-clinical, time and motion study was carried out to estimate the mean time required to perform cataract surgery from the moment a patient entered a medical care unit until the day of surgery. The study was conducted with time estimates issued by a group of experts, ophthalmologists specializing in cataract surgery; no patient information was included.

Information generated by five public medical care units where phacoemulsification surgery is routinely performed was used. The group first designed a sequence of activities, which were considered to shorten the time to perform cataract surgery, these were:

1. Initial ophthalmological evaluation.
2. Specular microscopy.
3. Intraocular lens power calculation.
4. Electrocardiogram acquisition.
5. Laboratory sample collection.
6. Chest X-ray acquisition.
7. Cardiovascular surgical risk assessment.
8. Preanesthetic assessment.
9. Surgical scheduling consultation.
10. Surgical supply request.
11. Surgical supply reception.
12. Phacoemulsification surgery.

For each activity, the minimum, usual, and maximum time required in days, sequentially, in each medical care unit, were estimated. The minimum, usual, and maximum times were averaged across the units. For a beta distribution, the standard deviation of each activity was calculated by dividing the difference between the maximum and minimum time (range) by six[1].

The duration of activities that required more time on average was identified, in descending order. A beta distribution was used to estimate the mean time of each activity, with the following formula: mean time = (minimum time + [usual time × 4] + maximum time)/6. The mean time was rounded up to the nearest whole digit. The mean time of each activity was summed to obtain the mean time of the sequence of activities[1]; as activity 8 has two antecedents, only the one with the longest duration was considered in the sum.

Results

The average minimum and maximum values identified for each movement are presented in table 1, as well as their range and standard deviation. The activities whose time had the greatest dispersion were the period between the reception of supplies and the surgery, electrocardiogram acquisition, and intraocular lens power calculation.

The averages of the minimum, usual, and maximum times for each activity, as well as the mean time, are presented in table 2. The activities with a longer mean time were the period between the reception of supplies and surgery, cardiovascular surgical risk assessment, and electrocardiogram acquisition; those with a shorter mean time were the request and reception of

Table 1. Minimum and maximum times, range, and standard deviation of movements

Activity	Description	Minimum time (days)	Maximum time (days)	Range	Standard deviation
12	Surgery	23	96	73	12.2
4	Electrocardiogram acquisition	7	66	59	9.8
7	Cardiological assessment	30	62	32	5.3
3	Intraocular lens power calculation	4	54	50	8.3
9	Surgical scheduling appointment	11	49	38	6.3
2	Specular microscopy	4	48	44	7.3
1	Initial evaluation	7	40	37	6.1
6	Chest X-ray acquisition	11	36	25	4.2
5	Laboratory sample collection	11	30	19	3.2
8	Preanesthetic assessment	7	27	20	3.3
10	Supply request	2	17	15	2.5
11	Supply reception	2	17	15	2.5

supplies, preanesthetic assessment, and laboratory sample collection.

The mean time of the sequence of activities was 269 days. The duration of the sequence with the considered usual times was 244 days, while the minimum duration was 108 days.

The proportion of the mean time spent on studies and preoperative risk assessments was 40.9% (110/269 days), that for ophthalmological studies was 17.4% (47/269 days), and that for the time between the reception of supplies and surgery was 19.3% (52/269 days).

Discussion

A prolonged mean time was found to perform elective cataract surgery. The activities that require the most time are those corresponding to preoperative risk assessment, performing surgery once supplies are available, and preoperative ophthalmological studies.

As a reference, the standard waiting time for cataract surgery in Canada is 112 days[7], although another study from that country reported an average of 95.7 ± 77 days[8]. A Spanish study reported a waiting time of 123 days[9] and an Australian study identified that reducing the waiting time for cataract surgery from 12 to 3 months represented cost savings to the health system due to a reduction in the care of falls and traffic accidents[10].

The estimate in this study corresponds to medical care units that not only treat cataract patients, but also may require preoperative evaluation for multiple specialties. Furthermore, surgical spaces in these units are shared not only with other specialties but also with different ophthalmological procedures. Another characteristic to consider is that some units have the equipment for ophthalmological studies, while others require support from another institution to perform them.

Each institution participating in this study has its own pre-surgical care process, and in some cases, the times for the evaluated movements are shorter. When designing the process to be evaluated, activities that could sequentially identify patients with risk characteristics for phacoemulsification surgery, and that would allow a patient with low surgical risk to have faster access to their surgery. The sequence of activities varies according to each medical care unit, which operates according to its current procedures.

A limitation of the study is that the measurement was indirect, dependent on the group's opinion, but the surgeons' estimate allows identifying the elements of the process that consume the most time, in order to focus actions that can shorten them; to evaluate modifications to the process, activities should ideally be observed directly and a standardized measurement made, to estimate the impact of the intervention. Another limitation is that activities vary among

Table 2. Average times in movements

Activity	Description	Minimum time (days)	Usual time (days)	Maximum time (days)	Mean time (days)
1	Initial evaluation	7	20	40	22
2	Specular microscopy	4	18	48	21
3	Intraocular lens power calculation	4	24	54	26
4	Electrocardiogram acquisition	7	35	66	36
5	Laboratory sample collection	11	13	30	16
6	Chest X-ray acquisition	11	13	36	17
7	Cardiological assessment	30	43	62	44
8	Preanesthetic assessment	7	11	27	13
9	Surgical scheduling appointment	11	24	49	26
10	Supply request	2	4	17	6
11	Supply reception	2	4	17	6
12	Surgery	23	48	96	52

medical care units: some have an inventory of supplies, and having them before surgery only requires verifying their existence; others must request them from a supplier, so ensuring their availability before surgery involves a process external to the institution. A further limitation is that the study did not consider costs, which limits estimating whether an action to shorten an activity is viable with available resources and whether its implementation will allow greater efficiency in the future, even if it requires an additional initial investment.

A strength of the study is that it allowed indirect comparison of processes between institutions. By averaging the times reported by each unit, the magnitude to which the duration of activities could change can be estimated, which can be difficult if only one's own historical performance is used as a reference.

Measuring is necessary to modify. Even if the estimated measurements in this study can be improved, they allowed identifying bottlenecks where actions would be most effective; expanding cataract surgery coverage requires increasing surgical spaces and optimizing the preoperative process to take advantage of them.

A factor currently influencing the delay in surgical care for patients diagnosed with cataracts is the time elapsed between the patient's request for care at the health institution and the initial ophthalmological evaluation; this period is long and causes a low-risk surgical patient to progress to medium or high risk due to uncontrolled systemic and ophthalmological variables.

Beyond delaying visual recovery, deferral of cataract surgery represents a functional limitation for the patient that can interfere with their mobility to move around[11,12] (with the risk of falls and fractures)[13,14] and with their cognitive functions (which can lead to isolation and depression)[15,16]. From a public health perspective, preventing these complications and the benefit of cataract surgery on general health[17,18] adds value to interventions that can shorten the surgical process, such as having rapid access to resources for cardiovascular preoperative evaluation and ophthalmological diagnostic studies.

In a comment on defining cataract surgery prices in Canada, Falk mentions that "it is not right to allow people to deteriorate into semi-blindness because we cannot organize ourselves to provide a procedure in a timely manner"[19]. Although the author emphasizes costs, optimizing the process represents the possibility of significantly improving general health status, and it is worthwhile to strive for this.

Conclusions

In this study, 60% of the time consumed between the initial ophthalmological evaluation and surgery corresponded to preoperative risk assessments and

auxiliary ophthalmological studies; taking action on these elements of the care process (diagnostic equipment, cardiovascular evaluations), shortening their duration by providing timely access to them, would make it feasible to reduce the waiting time for phacoemulsification surgery.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of people and animals. The authors declare that no experiments on humans or animals have been carried out for this research.

Confidentiality, informed consent, and ethical approval. The study does not involve patient personal data and does not require ethical approval. SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that they did not use any type of generative artificial intelligence for the writing of this manuscript.

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