THE INFLUENCE OF MICROPAUSES ON SURGEONS’ PRECISION AFTER SHORT LAPAROSCOPY PROCEDURES

ANDRZEJ L. KOMOROWSKI1, DAVID DOMINGUEZ USERO2, JOSE RAMON MARTIN-HIDALGO RODIL2, ROMAN TOPOR-MADRY2, 4

Department of Surgical Oncology, Maria Skłodowska-Curie Memorial Cancer Centre in Cracow1
Kierownik: prof. dr hab. J. Mituś
Department of General Surgery, Hospital Virgen del Camino, Sanlucar de Barrameda, Cadiz, Spain2
Kierownik: dr J. R. Martin-Hidalgo Rodil
Institute of Public Health, Jagiellonian University Collegium Medicum in Cracow3
Kierownik: prof. dr hab. A. Pająk
Wrocław Medical University, Faculty of Health Sciences4
Kierownik: dr hab. A. M. Fal, prof. AM

It has recently been shown that micropauses during long surgical procedures can be beneficial for surgeons’ precision and fatigue. The aim of the study was to evaluate the impact of micropauses on surgical precision measured by a simple smartphone application.

Material and methods. Two surgeons performed 40 simple laparoscopic procedures (appendectomy and cholecystectomy) with or without micropauses. After the operation the precision of surgical movements was measured by a simple smartphone application in which the number of successful trials and their mean time were used as a precision surrogate.

Results. Mean number of successful trials was significantly higher for appendectomy than for cholecystectomy (5.59 vs 4; p = 0.032). There was a difference between participating surgeons both in terms of number of successful trials (5.80 vs 3.55; p = 0.01) and a mean time of all successful trials (10.03 vs 6.28; p = 0.001). No other statistically significant differences were identified.

Conclusion. Micropauses had no influence on surgical precision as evaluated after short laparoscopy procedures. The only differences were surgeon-dependent and intervention-dependent.

Key words: laparoscopy, surgical technique, surgical precision

There are several factors influencing surgeons’ precision and strength during surgery. Forced position, long duration of surgery and stress all add to the fact that after several hours in the OR surgeons tend to lose their peak operative ability. Back pain, neck pain and muscle fatigue are important source of distress for surgeons and can influence their performance and precision of movements (1). Recently it has been shown that performing short breaks (micropauses) every 30 minutes during long surgical procedures can result in better precision, less fatigue and better maintenance of hand force (2).

In this study we speculated that performing similar short breaks every 15 minutes during simple laparoscopy procedures of less than 1 hour duration such as cholecystectomy and appendectomy can have a positive impact on precision of surgical movements.

MATERIAL AND METHODS

The project was approved by the Ethics Committee of the Hospital Virgen del Camino in Sanlucar de Barrameda, Spain. Data were analyzed in a blinded fashion by the authors. For the difference testing the t-test was used, and logistic regression for the multivariate analysis. For the analysis the association between the mean time of test and the number
of incomplete tests the Pearson correlation was applied. Statistical tests were made using SPSS v 21. p-value was set at 0.05.

Design

Two surgeons (ALK and DDU) participated in the study. The randomization was performed using a web-based random numbers generator available at www.randomizer.org. Two sets of 20 random elements were generated. Each set was attributed to one particular surgeon. Once a patient fulfilling inclusion criteria was scheduled to be operated on by one of the participating surgeons the randomization code was opened to define whether during surgery the study intervention will be performed or not. The intervention consisted on micropauses every 15 minutes during laparoscopy. At the end of every operation the surgeon was asked to perform an accuracy and precision test.

Patients eligibility

All consecutive patients scheduled for a laparoscopy procedure of estimated duration of less than 1 hour to be performed by one of the participating surgeons were eligible for the study.

Micropauses

Every 15 minutes starting from the skin incision, an alarm would go off from a standard smartphone operated by one of the circulating nursing staff. Surgeons were instructed to stop operating, pull out of the working station, and stretch neck, shoulders and hands while looking in the direction opposite to the operation table for 30 seconds.

The micropauses were repeated every 15 minutes until the last skin suture was placed and timing of the whole procedure was concluded.

Accuracy test

After terminating each operation, the surgeon was asked to play the „Horseshoe” level of the iPhone application „Reverse Maze” (©Ironshod, New Zealand) standing in an upright position directly after taking off the surgical gloves. The „Horseshoe” level of the application consists of following a horseshoe-shaped track with a cursor that follows the index finger of a player on an iPhone display. Contacts with the border of the track are considered errors, recorded and result in restarting the level. The circuit was repeated at least 10 times to obtain at least 3 complete maze times. The additional difficulty of the application consists of the fact that the cursor moves in the direction opposite to the movement of the player’s finger. The surgeon was asked to try to accomplish the maze as fast as he could while staying in the upright position. For every attempt the completion time or error were recorded. During the study period the participating surgeons were not allowed to use the application outside the study.

To validate this smartphone application as an evaluation tool we have performed a set of baseline data prepared in a standardized manner. Each participating surgeon was not allowed to play the application for three months before the start of the study. After this period of time and after 30 minutes of rest in bed each surgeon was asked to play the application in standing position at least 10 times in order to obtain at least 3 full time results. The times and the number of mistakes were recorded and considered a baseline result in further analysis. The baseline differences between surgeons (mean times, number of successful mazes, number of fails) were calculated and their weight included in the final statistical analysis.

RESULTS

Surgery time, number of trocars used, type of surgery and whether the surgery was performed with or without assistant were all recorded in a prospective manner. The results are presented in tab. 1. For evaluation of precision we have used both the number of successful trials (number of times for which a complete maze time was achieved) and mean time of all successful trials (mean time of completing a maze). Both of the variables had a significant correlation (R=0.48). We
have found that the mean number of successful trials was significantly higher for appendectomy than for cholecystectomy (5.59 vs 4.00; \( p = 0.032 \)). There was also a statistically significant difference between participating surgeons both in terms of number of successful trials (5.80 vs 3.55; \( p = 0.01 \)) and mean time of all successful trials (10.03 vs 6.28; \( p = 0.001 \)). All other comparisons including intervention versus control group did not reach statistical significance. For the multivariate analysis of the difference between the mean time of successful trials we have included the type of surgery and surgeon variability but we still couldn’t find any statistically significant difference (OR=1.39, 95%CI 0.92-2.13) which didn’t change after adding the number of unsuccessful trials in the model.

In our experimental study we have speculated that short, 30 seconds micropauses every 15 minutes during standard laparoscopy procedures (appendectomy and cholecystectomy) will result in better precision of surgical movement as measured by a simple smartphone application. Our results failed to show any statistical difference between the study groups. However, after performing cholecystectomy both surgeons were more likely to complete a precision trial. This would mean that in our study the surgeons were less tired after cholecystectomy than after appendectomy. This is in contrast to the findings by Papandria, who analyzed risk of conversion to open surgery in a cohort of 176,014 laparoscopic operations and found that cholecystectomy bears significantly higher risk of conversion than other laparoscopic procedures, including appendectomy (5).

It can be a matter of discussion what is the optimal number of participants in this type of experimental study. In case of inviting more surgeons to participate the influence of individual skills can obscure the results (6). This is especially true since our aim was not to compare surgeons but to compare the influence of intervention with no intervention on surgical precision measured by a simple smartphone application. To eliminate the influence of individual gaming skill from final analysis we have established a baseline to which further results were statistically compared. This step proved to be important

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of successful trials</th>
<th>Time of trial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>mean</td>
</tr>
<tr>
<td>Intervention</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Type of surgery</td>
<td>cholecystectomy</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>appendectomy</td>
<td>17</td>
</tr>
<tr>
<td>Skill of a surgeon</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>With assistant</td>
<td>no</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>33</td>
</tr>
<tr>
<td>Number of trocars used</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>15</td>
</tr>
</tbody>
</table>
as in further analysis we have found the difference in the results of a precision test between participating surgeons. This could be easily explained by the fact that both surgeons have known the application before the study and played it for a different amount of time thus reaching a different level of expertise. As stated before, this difference was equilibrated in the final statistical analysis with the help of baseline set of results weighted against study result of each participating surgeon.

Another important weakness of our study is a relatively simple validation of our smartphone-based test. On the other hand the rules of using the application and its results are quite similar to other, clinically validated tests for surgical precision (2).

An interesting observation regarding precision of movements was made by Hogle et al. In their study they found that training in surgical simulators that focuses on precision of movements can actually lengthen the operative time since the precision requires more time during surgery (7). This phenomenon could also play a role in our study since during the accuracy tests used by our group the surgeon could concentrate either on obtaining more complete mazes or better maze times.

Another observation was made by our group during the implementation of the study protocol. Both participating surgeons would easily forget about micropauses during surgery if it weren’t for the nursing staff who would remind us of the necessity of sticking to the protocol. The same was true for others: the same groups that proved the beneficial effect of microbreaks in longer surgery has admitted a relatively low compliance to experimentally established protocol. Among the reasons for such a low compliance the authors cite a feeling of invincibility, a lack of awareness, a touch of laziness, and a leave-me-alone attitude. In order to overcome these obstacles, Dorion and Darveau found that the nursing staff should be responsible to “enforce” the breaks and thus set the rhythm of the operation just like it happened during our study (2).

The video games have been shown to have a positive influence on endoscopic and laparoscopic skills (8). Smartphones have also been shown to allow better surgery planning with 3-D models projected on patient body (9) and a smartphone application has been successfully used for evaluation of residents’ intraoperative skills (10).

In our study we have tried to use a smartphone application as an instrument to measure the precision of surgical movements. Although our results are not very encouraging the simplicity of the test and promising results obtained in longer and more complex surgery warrant future research in the field of micropauses and its role in surgery as well as the way a common smartphone can add a small piece to our surgical knowledge.

CONCLUSION

Micropauses every 15 minutes during short laparoscopy procedures had no influence on surgical precision as measured by a simple smartphone application.

REFERENCES


Received: 26.01.2015 r.
Adress correspondence: 31-115 Kraków, ul. Garncarska 11
e-mail: z5komoro@cyf-kr.edu.pl