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Araştırma

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Comparison Of Diaphragm Thickness Values In Cases of Adenotonsillectomy Before And After The Operation

Adenotonsillektomi Olgularında Ameliyat Öncesi ve Sonrası Diyafram Kalınlık Değerlerinin Karşılaştırılması

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ABSTRACT

Aim: Measurement of the thickness of the diaphragm is a parameter that can be used to decide before separation from mechanical ventilation and extubation. In these cases where intubated and extubated at the end of the operation, it is planned to examine the ratio of the aperture muscle thickness to each other in the last inspirium and exprium before extubation. Determining the current ratio may be meaningful for determining the extubation time.

Material and Method: In the study, 60 patients, who were in the physical state of ASA I and II, 3-12 age range, and who were scheduled for elective adenotonsillectomy operation were included. Age, gender, body mass index (BMI), and operation time data of patients were recorded. Before and after the procedure, inspiratory and expirtuar diaphragm thicknesses were measured by ultrasonography. In addition, the ratio of the last inspirium and the diaphragm muscle thicknesses in the last expiration were also calculated.

Results: There was no significant difference between the pre-operation values and the end of the operation in the diaphragm thickness measurements. The incidence of laryngospasm was 1.5 %.

Conclusion: Diaphragm thickness measurements with ultrasound have many benefits but further studies are needed.

Key Words: Diaphragm, Ultrasound, Pediatric, Anesthesia

ÖZET

Amaç: Diyaframın kalınlığının ölçülmesi, mekanik ventilasyon ve ekstübasyon ayrılmadan önce karar vermek için kullanılabilecek bir parametredir. Ameliyat sonunda entübe edilen ve ekstübe edilen bu olgularda ekstübasyon öncesi son inspirum ve son ekspiryumda diyafram kas kalınlığının birbirine oranının incelenmesi planlanmıştır. Bu oranın belirlenmesinin ekstübasyon süresinin belirlenmesinde anlamlı olabileceği düşünülmektedir.

Gereç ve Yöntem: Çalışmaya elektif adenotonsillektomi operasyonu planlanan 3-12 yaş aralığında fiziksel durumu ASA I ve II olan 60 hasta dahil edildi. Hastaların yaş, cinsiyet, vücut kitle indeksi (VKİ) ve operasyon süresi verileri kaydedildi. Ameliyat öncesi ve sonrası ultrasonografi ile inspiratuar ve ekspiratuar diyafram kalınlıkları ölçüldü. Son inspiryum ve son ekspirasyondaki diyafram kası kalınlıklarının oranı hesaplandı.

Bulgular: Diyafram kalınlık ölçümlerinde ameliyat öncesi değerler ile ameliyat sonu değerleri arasında anlamlı fark yoktu. Laringospazm insidansı %1.5 idi.

Sonuç: Ultrason ile diyafram kalınlığı ölçümlerinin birçok faydası vardır ancak daha ileri çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: Diyafram, Ultrason, Pediatrik, Anestezi

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Introduction

When determining whether a patient can be successfully extubated, timing is critical [1]. Weaning of mechanical ventilation too early can induce an increase in cardiovascular and respiratory stress, CO2 retention, and hypoxemia [1-3]. Extubation timing is even more important, especially in child cases. Child cases are more prone to laryngospasm and hypoxemia[2, 3]. Due to the reality of those, determining the fact that the patient is completely saved from the effect of the neuro-muscular blocker agent [4].

The use of ultrasonography (US) in the operating room tends to increase recently and, US is a kind of assessment device which can be used to appraise the thickness of the diaphragm [5, 6]. Appraisement of the thickness of the diaphragm is a parameter that can be used to separate from mechanical ventilation and pre-extubation [5, 7]. Appraisement of the thickness of the diaphragm with US is a non-invasive, easily accessible method and may guide the patient in anesthesia in terms of extubation timing [4, 6]. Adeno-tonsillectomy operations are one of the frequently applied operations in children [8-10]. In these cases where intubated and extubated at the end of intervention, it is thought that an objective parameter could be obtained for extubation timing by examining the ratio of the diaphragm muscle thickness to each other in the last inspirum and last exprium before extubation. It is planned that the determination of this ratio may be meaningful for the determination of the extubation time.

Material and Methods

With the approval of the Ethics Committee and the approval of the volunteers with written forms, 60 patients, who were in the physical state of ASA I and II, 3-12 age range, and who were scheduled for elective adenotonsillectomy operation were included. Age, gender, body mass index (BMI), and operation time data of patients were written down. Before and after the operation, inspiratory and expritуar diaphragm thicknesses were measured by ultrasonography. The ratio of the last inspirium and the diaphragm muscle thicknesses in the last expiration were calculated the consensus of the extubation criterion was examined.

Patients with a physical defect to prevent US examination, the children of the parents who do not know Turkish literacy and did not agree to participate in the study were excluded. Before and at the end of operation, inspiratory and expritуar diaphragm thicknesses were measured by ultrasonography. Patients who underwent adenotonsillectomy operations involved in the study were measured in a 45-degree head-up position while measurements were performed. Right hemi-diaphragm, 8th and 10th intercostal gaps midaxillary between the diaphragm and rib cage is displayed by ultrasonography from the area where the cage was settled, and the last exprium and the last inspirium muscle thickness were recorded. The ratio of the last inspirium and the last exposure of the last exposure was measured by measuring muscle thicknesses. Induction of anesthesia was performed with 2-4 mg/kg of propofol, rocuronium 0.6 mg/kg and 1 mcg/kg fentanyl. It was maintained with 2% sevofluran and 60% nitrogen oxide in oxygen. Extubation was determined by the anesthesist, including the study, considering awake extubation criteria. In the initiation and continuity of anesthesia, cases other than the above-mentioned induction and maintenance regulations were excluded. In the study, anesthesia induction and maintenance were not involved.

Results

Sixty patients undergoing adenotonsillectomy were enrolled from September 2018 to October 2019 in the study (Table 1). During this period, three eligible patients were excluded: 3 refused informed consent. When we look at the demographic values, for the gender of the patients, there was a statistic difference within the patients ($p<0.001$). About the age, There was a statistic difference within the patients ($p<0.001$). When we consider BMI statistically, There was a statistic difference within the patients ($p<0.001$).

The operation time was recorded. When we consider operation time statistically, There was a statistic difference within the patients ($p<0.001$). The SPO2 values were recorded as a preoperative and preextubation period. When we consider the SPO2 values with correlation test statistically, There was a correlation within the patients in preoperative and preextubation period. ($p=0.016$, $R=0.311$).

Table 1. Characteristics of Patients Undergoing Adeno-tonsillectomy

Characteristics	**n/mean**
Sex, Male:Female	30/30
Age (years)	7.41
Body mass index (kg/m2)	16.35
Operation time (min)	51.05

Table 2. Sonographic Variables PreOT(preoperative time) and PreET(preextubation time)(mean)

Sonography	PreOT (preoperative time)	PreET (preextubation time)
DIA (deep, cm)	0.52	0.50
DEA (deep, cm)	0.50	0.47

Sonographic Data

The perioperative DIA (diaphragmatic inspiratory Amplitude) and DEA (diaphragmatic expiratory Amplitude) values during breathing before and after adenotonsillectomy were summarized in Table 2. After adenotonsillectomy, DIA and DEA values determined a eloquent degree of decrease from their preoperative values on PreOT(preoperative time) and PreET(preextubation time) when we considered the values with correlation test ($P < 0.001$). (Table 2, Fig. 1A and 1B).

When we considered the spasm and DIA and DEA with a correlation test, there was no correlation within the patients. The results of the spasm were showed in table 3.

Discussion

In medical interventions, many efforts are made to reduce complications. Each clinical discipline is a tremendous effort to prevent complications related to itself. Especially in child cases, complications can develop much faster, measures must be kept at the highest level. In particular, anesthetists may encounter many complications in surgical procedures involving the supraglottic airway [4, 11-13]. The safe intubation of the patient is a part of the anesthesia physician until safe transfer after the operation is followed by vital data during the operation and after being extubated. Extubation timing is also a critical detail. Although there are methods that provide numerical data, such as neuromuscular monitoring (NMT), Bi-Spectral Index (BIS), and Near Infra-Red Spectroscopy (NIRS), complications can be encountered [2, 3, 10, 14]. There are also question marks about NMT monitoring in pediatric cases such as dosing the current. Additionally, most NMT monitor apparatus are designed for adult sizes. The difficulties related to the implementation of NMT in child cases pushed the anesthetists to different searches [14]. The way that assessment of diaphragm and aperture via US, is one of the results of these inquisitorials [2, 3]. Non-invasive and easy to apply (even when the patient is awake) is the advantage. However, disadvantages such as access to the device and physician experience are also available. According to the results of our study, there is no statistically significant difference between the diaphragmic thicknesses measured during the extubation times of physicians and pre-operation values. In addition, the fact that laryngospasm has been observed in only one case (1.5%). Laryngospasm incidence has been reported from %4 to % 16 [15] in different studies. However, in our study laryngospasm incidence was lower. That data could not have been correlated with other studies. Because in our study, just muscle contraction has been confirmed by US guidance and it is not expected to have a lower incidence.

Table 3. The Pearson correlation test values (R) about spasm with PreOT(preoperative time) and PreET(preextubation time)(mean)

Spasm	PreOT (preoperative time)	PreET (preextubation time)
DIA (deep, R) / *P*	-0.43/0.743	-0.45/0.731
DEA (deep, R) / *P*	0.13/0.923	-0.61/0.642

In our study, it is a result that has in prospect to be a considerable distinction between the pre-operation and the end of the intervention in the assessment of US and diaphragm thickness. Accordingly, the evidence of the methods that the muscle thickness has reached pre-operation values with the measurements made is evidence that the method may be useful, but considering the limitations of the study, our evidence is weak. Because NMT has not been used, an objective process cannot be followed for extubation timing.

Limitations: Being not tracked of complications in Postoperative 24 hours period, and not applying NMT and standardized postoperative analgesia, represent the limitations of the present study.

Conclusion: According to our data, there was no significant difference between the pre-operation values and the end of the operation in the diaphragm thickness measurements. The incidence of laryngospasm was 1.5 %. these data showed that diaphragm thickness measurements with ultrasound have many benefits but further studies are needed with larger study groups to confirm that data and to widen its correlation.

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