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Original Article / Özgün Araştırma

Obturator Nerve Block in Adductor Spasticity: Comparison of Peripheral Nerve Stimulator and Ultrasonography Techniques

Adduktor Spastisitede Obturator Sinir Blokajı: Periferik Nörostimülatör Tekniği ile Ultrasonografi Tekniğinin Karşılaştırılması

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Abstract / Özet

Objective: Obturator nerve blockade, which is commonly used in the treatment of spasticity, is a very difficult nerve block. Ultrasonography (USG) has been widely used in recent years for nerve blocks. The aim of this study was to compare peripheral nerve stimulator (PNS) and ultrasound (US) in obturator nerve blockade in patients with adductor spasticity.

Methods: Patients were randomly divided into two groups. Group-PNS patients had a peripheral nerve stimulator guided obturator nerve block, and Group-USG patients had US-guided obturator nerve block. Age, gender, length and weight of patients were recorded. The period of the block, the number of punctures until successful block, the necessity for a repeated block, spasticity assessment (using the Ashworth scale), complications, patient satisfaction, and practitioner satisfaction were recorded.

Results: The average number of punctures in Group PNS was 2.0 (1.0 to 6.0) and in Group USG was 3.0 (1.0 to 5.0); there was no statistically significant difference between the two groups. The average time of the block was 10.0 min in Group PNS (2.0 to 30.0) and 16 min (4.0 to 35.0) in Group USG, and no significant differences were detected. The patient and the practitioner satisfactions were not statistically different between the two groups.

Conclusion: Clinical studies showed that USG-guided regional blocks were safer and more efficient than other conventional techniques. However, there are very few studies comparing USG and other techniques; therefore, more studies are needed.

Key Words: Obturator nerve, nerve block, ultrasound

Amaç: Spastisite tedavisinde sık kullanılan obturator sinir blokajı, yapılması en güç periferik sinir blokları arasındadır. Ultrasonografi (USG) son yıllarda sinir blokları için oldukça sık kullanılmaktadır. Çalışmamızın amacı adduktor spastisitesi olan hastalara uygulanan obturator sinir blokajında kullanılan periferik sinir stimülatörü ile USG yöntemlerinin karşılaştırılmasıdır.

Yöntemler: Hastalar, rastgele iki gruba ayrıldı. Grup-PNS'de bulunan hastalara periferik sinir stimülatörü (PNS) eşliğinde obturator sinir bloğu ve Grup-USG'de bulunan hastalara USG eşliğinde obturator sinir bloğu uygulandı. Hastaların yaş, cinsiyet, boy, vücut ağırlığı gibi demografik verileri kaydedildi. Ayrıca blok yapılma süresi, blok oluşturuncaya kadar yapılan ponksiyon sayısı, tekrar blok yapılma gerekliliği, spastisite değerlendirmesi (Ashworth skalası kullanılarak), komplikasyon olup olmadığı, hasta memnuniyeti, uygulayıcı memnuniyeti kaydedildi.

Bulgular: Ponksiyon sayısı Grup PNS'de ortalama 2,0 (1,0-6,0) Grup USG'de ortalama 3,0 (1,0-5,0) olarak bulundu ve iki grup arasında istatistiksel bir fark saptanmadı. Blok yapılma süresi Grup PNS'de ortalama 10,0 dk (2,0-30,0) Grup USG'de 16 dk (4,0-35,0) olarak bulundu ve anlamlı farklılık saptandı. Hasta ve uygulayıcı memnuniyeti açısından her iki grup arasında istatistiksel fark bulunmadı.

Sonuç: Klinik çalışmalar USG rehberliğinde rejyonal blokların diğer geleneksel tekniklere göre daha etkin ve güvenli olduğunu göstermektedir. Fakat USG ile diğer teknikleri karşılaştıran çok az sayıda randomize kontrollü çalışma olması nedeni ile daha fazla çalışmaya gerek vardır.

Anahtar Kelimeler: Obturator sinir, sinir bloku, ultrason

Introduction

Spasticity derives from the Greek word "spastikos" which means 'to pull and drag' it is a serious problem for medical rehabilitation programs (1). Spasticity is characterised by a velocity-dependent increase in tonic stretch reflexes following upper neuron damage (2). According to these definitions, spasticity is a state of hypertonia, which presents with deterioration of tonus control intertwined with other symptoms and exaggerated responses formed by input and output in clinical pictures dependent on the deterioration of central nervous system (CNS) coordination caused by the damaged upper motor neuron.

Three approaches are known in the treatment of spasticity: 1. Pharmacological treatments; 2. Physical therapy; and 3. Surgical treatments.

Agents used for the pharmacological treatment of spasticity are intended to decrease the over-activity of muscles. These agents become effective by decreasing the excitability of the CNS, neuromuscular junction and motor pathways. However, they affect all muscle groups and potential adverse effects restrict their usage substantially. For this reason, local treatments are more desirable to decrease muscle over-activity affecting certain muscle groups (3).

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In 1993, obturator nerve blocks and the inter-adductor approach were suggested by Wassef et al. (4) to treat spasticity. Phenol was initially used in the treatment, in order to increase the duration of it in the 1960s. From that time, it has been used for the over-activity of upper and lower extremity muscles, especially in adult patients with traumatic brain injury, stroke, and cerebral palsy. While it is generally applied by using guide points with a peripheral nerve stimulator (PNS), ultrasonography (USG) has recently gained popularity to help with the application of regional blocks (5).

The objective of our study is to compare peripheral nerve stimulator and USG methods used in obturator nerve block applied to patients with adductor spasticity.

Methods

After approval by the Clinical Trials Local Ethics Committee (05.05.2009 and 2009-8/12) and written informed consent, 30 patients aged 18-65 years, ASA (American Society of Anaesthesiologists) I-II were enrolled in the study.

Exclusion criteria included:

1. Patients who did not wish to be included in the study,
2. Patients with acute pancreatitis,
3. Pregnant and lactating patients,
4. Patients with hepatic or renal insufficiency,
5. Non-Cooperative patients,
6. Patients with coagulation disorders,
7. Patients who had an allergy to lidocaine or phenol.

Patients were randomly divided into two groups by selecting a sealed envelope. Obturator nerve block was applied with a peripheral nerve stimulator to the patients in Group PNS and with USG in Group USG. Demographic data of patients such as age, sex, height, and weight were recorded. After the procedure, block time, the number of skin punctures until successful blockage, necessity of repeat intervention, spasticity evaluation using Ashworth scale, whether there was a complication or not, patient satisfaction and operator satisfaction were also recorded (6).

Patients in Group PNS were prepared under the sterile conditions of the operating room. Peripheral O_2 saturation (SpO_2) was routinely applied to patients and their non-invasive blood pressures were monitored. Spasticity of patients was evaluated by Ashworth scale and recorded. In the supine position, a 21G stimulator needle was inserted 1.5 cm below and 1.5 cm lateral of the pubic tubercle. When the direction of the needle was moved towards superior pubic arm in the direction of the posterior and made contact with bone, the needle was directed to the lateral and caudal, and was progressed 2-4 cm further to enter the obturator foramen. When adductor motor response was received to a stimulator current of 0.5 mA, 2 mL lidocaine was given and then neurolytic block was applied with 4 mL of 5% phenol.

Patients in Group USG were also prepared under the sterile conditions of the operating room. Routine SpO_2 and blood pressure monitoring were applied. Spasticity was recorded. Then, a high frequency ultrasound probe was placed below the inguinal ligament medial to the femoral artery in order to identify obturator nerve. The obturator nerve was seen as a hypoechoic spindle in a hyperechoic thick layer, which is medial of femoral vein, m.pectineus, m.adductor longus, and m.adductor brevis (Figures 1, 2). The needle was inserted through the medial of the probe using an in-plane approach. At the same time, the nerve was stimulated using a 1 mA (2Hz, 0.1 ms) current. The needle was slowly progressed until adductor spasm occurred. Simultaneously, the needle was observed on the ultrasound images as it passed through muscle layers and contacted with deep and superficial branches of the obturator nerve. After the first spasm was seen, the current was gradually decreased to 0.5 mA. Then, neurolytic block was applied to both branches of the obturator nerve, first with 2 mL lidocaine followed by 2 mL of 5% phenol.

Then, the patients were evaluated in the post-anaesthesia care unit in terms of spasticity after 30 minutes and 1 hour using the Ashworth scale by an algology resident. A month after this procedure, the patients were called for follow-up at the algology clinic and their spasticity was evaluated. The patients were evaluated further by their referring clinics. When a repeat intervention was indicated, the patients were referred to the pain clinic again.

Statistical analysis

Data analysis was performed at Uludag University Medical Faculty, Biostatistics Department using SPSS 13.0. Categorical data was analysed by Pearson chi-square and Fisher's exact chi-square tests. Descriptive values for continuous variables are expressed as mean±standard deviation or median (minimum-maximum) according to the distribution. A p value <0.05 was considered as significant.

Results

One patient in Group PNS was excluded from the study because of a coagulation disorder. There were no significant differences in terms of demographic data (Table 1).

The number of skin punctures until successful blockage was found to be 2 (1-6) on average in Group PNS and 3 (1-5) on average in Group USG (Table 2); the difference was not significant. The average time needed to complete the block was 10 minutes (2-30) in Group PNS and 16 minutes (4-35) in Group USG; this difference was statistically significant (p<0.05).

There was no difference in the average Ashworth scale of the patients before the block (Table 3). In the first hour after the block, the Ash-

Table 1. Demographic data of patients

	Group PNS	Group USG	p
Age (years)	48.5 (24-64)	30 (18-54)	0.051
Weight (kg)	67.5 (50-92)	70 (48-95)	0.880
Height (cm)	171 (160-182)	165 (155-185)	0.085
ASA	I (I-II)	I (I-II)	0.715

Data were given as median (minimum-maximum)
PNS: Peripheral nerve stimulator, USG: Ultrasonography, ASA: American Society of Anaesthesiologists risk score

Table 2. Comparison of number of punctures and duration of the procedure

	Group PNS	Group USG	p
Duration of procedure (min)	10 (2-30)	16 (4-35)	0.041*
Nr. of punctures	2 (1-6)	3 (1-5)	0.123

Data were given as median (minimum-maximum)
PNS: Peripheral nerve stimulator, USG: Ultrasonography

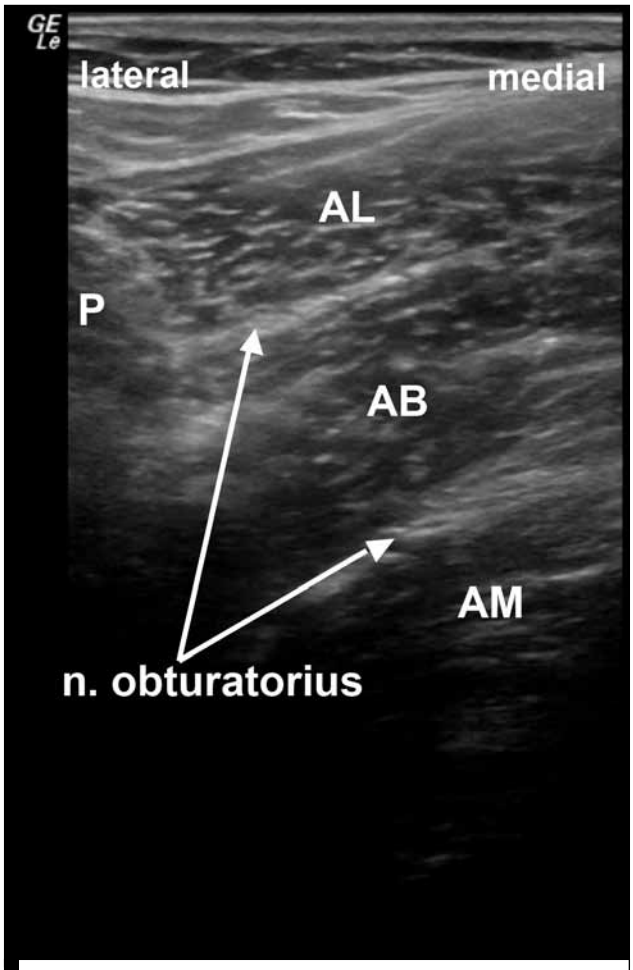

Figure 1. Anatomical landmarks
AL: m. adduc. longus, AB: m. adduc. brevis AM: m. adduc. minimus, P: m. pectineus

Figure 2. Position of the USG probe

Table 3. Ashworth scores before block, 30 minutes, 1 hour, and 1 month after block, and time to repeat block

	Group PNS	Group USG	p
Ashworth scores before block	3.0 (2.0-4.0)	3.0 (2.0-4.0)	0.331
Ashworth scores after 30 mins	2.0 (2.0-4.0)	3.0 (2.0-4.0)	0.377
Ashworth scores after 1 hour	2.0 (2.0-4.0)	2.0 (2.0-4.0)	0.813
Ashworth scores after 1 month	3.0 (2.0-4.0)	2.0 (1.0-3.0)	0.683
Days to repeat block	177.5 (7-500)	188.0 (30-500)	0.662

worth scale was found to be similar in both groups, with a score of 3 on average (2-4). In the first month, the Ashworth scale was 2 on average (1-4) in Group PNS and 2 on average (1-3) in Group USG. There were no differences in Ashworth scale scores at the first hour and first month between groups. Patient and operator satisfaction were similar in both groups.

After the routine monthly controls of the patients, 12 cases in Group PNS and 10 cases in Group USG had obturator phenol block repeated. When the duration of blocks was considered, Group PNS and Group USG patients showed block repetition after 177.5 days and 188.0 days on average, respectively.

Discussion

In our study, obturator nerve block was applied to 29 patients with adductor spasticity of various aetiologies, either by PNS or US. Spasticity of the patients was evaluated with the Ashworth scale. No significant difference was observed between the two groups in terms of efficacy and duration of block. The time needed to complete the block was similar in both groups.

Spasticity is a syndrome which appears together with a persistent increase of involuntary reflex activity of a muscle in response to stretch (tension). Adductor muscle spasticity is an important complication of multiple sclerosis, spinal cord damage, traumatic brain injury and cerebral palsy. In these patients, spasticity increases because of pain or by applications like perineum hygiene and poses difficulty in physiotherapy and ambulation. In the treatment of spasticity, oral drugs (baclofen, tizanidine, clonidine, etc.), minimally invasive treatments (intrathecal baclofen pump and neurolytic applications) and surgical interventions (rhizotomy, myelotomy) can be applied. Peripheral nerve blocks with chemical agents or chemical neurolysis have been shown to decrease spasticity by interrupting the strong reflex arc. In hip adductor spasticity, neurolysis of obturator nerve is frequently used (7). The treatment of spasticity should be initiated as early as possible once the pain occurs and begins to affect the patient's life (8).

Obturator nerve block was applied for the first time by Labat et al. (9). This block can be used for post-operative analgesia in hip and knee surgery, in transurethral resection surgery for obturator reflex inhibition, in the treatment of seriously chronic hip and knee pain, and in the treatment of spasticity.

In a study conducted by On et al. (10), the impact of phenol block on electrophysiological tests of spinal afferent and efferent fibres was evaluated. It was concluded that the spasticity-decreasing effect of phenol block primarily depended on inhibition of alpha motor fibres; Ia afferent inhibition and to a lesser extent gamma fibre inhibition contributed to this effect.

In the study by Wolf et al. (11), lateral plantar nerves of rats were kept in 7% phenol solution for 20 minutes and innervation in plantar lumbrical muscles was evaluated using specific monoclonal antibodies. After four weeks, more than 80% of muscle spindles were totally denerved, while only the afferent ones were innerved; however, there was no gamma efferent innervation in any muscle spindles. After six weeks, it was observed that more than 90% of spindles had afferent innervation, and gamma innervations developed in 38% of them. As a result of this study, it was concluded that phenol block caused a complete denervation in muscle spindles, which is followed by quick sensorial reinnervation; the reinnervation by gamma motor neurons was incomplete or obviously late.

There are few studies about patients who underwent obturator nerve neurolytic treatment. Kong et al. (12) applied obturator nerve block using alcohol in patients with spasticity and reported that there was a decrease in spasticity lasting at least six weeks. They observed an effect lasting for 18 months in 6 cases and there were no important complications during these 18 months.

Viel et al. (13) applied 65% ethanol block to 23 patients with hemiplegic-paraplegic adductor spasticity using fluoroscopy with the inter-adductor approach and reported that they were able to localise the nerve with 100% accuracy. There was a significant improvement in spasticity and hygiene scores, and this effect was present even after 4 months.

Trainer et al. (14) used 6% phenol for obturator nerve block in patients with cerebral palsy and observed clinical improvement for 6 weeks.

In another study, which utilised perineural block obturator, posterior tibial and median nerve blocks were applied with 6% phenol in 116 cases whose perineal care and ambulation were affected and it was reported that there was a decrease in spasticity and improvement in ambulation. The duration was 13 months on average and it ranged from 3 to 18 months (15). In five cases, complaints of paresthesia arose and the process was repeated in 11 cases. Although successful results were reported with phenol block, pain on application restricted its usage.

The most common complication of neurolytic block with phenol is dysaesthesia. Other complications are injection pain, muscle necrosis, skin damage and interstitial fibrosis. Dysaesthesia was not observed in our patients as most had traumatic spinal cord damage together with significant sensorial deficit. No other complications were observed in the study group.

Soong et al. (16) evaluated the obturator nerve with US in 20 volunteers assessing the size, shape and depth of the nerve. They observed that the obturator nerve and its branches were the flattest ones among all peripheral nerves imaged with US. They suggested that knowing how obturator nerves are seen with USG facilitated regional block application and increased the success of the procedure.

Helayel et al. (17) applied obturator nerve block using USG for analgesia in 22 patients who underwent knee surgery. The time which was necessary for nerve definition, the current which formed the minimum response, time necessary for correct definition, pre-block and post-block adductor muscle strength, sensory block and quality of surgical conditions were recorded. The authors reported that obturator nerve definition and block application were technically easy and the success rate was high.

Manassero et al. (18) applied obturator nerve block with interfacial injection of local anaesthetic with ultrasound to 50 patients who developed adductor spasticity after transurethral bladder tumour resection with spinal anaesthesia. They compared onset time of motor block, block time, time and the number of needle entries related to total anaesthesia with an application using a peripheral nerve stimulator. It was found that block time was shorter in the ultrasound group, while the success of the block was higher in the peripheral nerve stimulator group. The number of attempts before successful block was similar in both groups. It was found that block time was longer in the peripheral nerve stimulator group; however, there was no difference among times related to total anaesthesia.

Abrahams et al. (19) performed a meta-analysis and systematic review of randomised controlled trials using two methods. They evaluated block efficacy with ultrasound in terms of onset time of block, block duration and risk of complications, and they observed that ultrasound was significantly more efficient and reliable than PNS in terms of these parameters.

Our study has some restrictions. One is our lack of experience, since peripheral nerve block using the USG technique is relatively new; also, we did not have sufficient number of patients, we lacked an inpatient service where we can observe the clinical course of patients, and future follow-ups of patients were performed by referring clinics.

Conclusion

Peripheral nerve blocks are used in the treatment of spasticity and intraoperative-postoperative analgesia. Clinical studies show that regional blocks with the guidance of USG are more efficient and reliable than conventional techniques. Technical developments in ultrasound have facilitated its clinical usage. Many anaesthesiologists use ultrasound in routine clinical practice in order to gain experience in this important technology. However, there is a need for more studies and for this technique to develop and spread since there are few randomised controlled trials that compare USG with other techniques.

Conflict of Interest
No conflict of interest was declared by the authors.

Peer-review: Externally peer-reviewed.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Clinical Trials Local Ethics Committee (05.05.2009, 2009-8/12).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Author Contributions
Concept - Ş.Ş., A.G.; Design - N.H.S., A.G., G.T.; Supervision - A.G., G.T.; Funding - N.H.S., S.K., A.A., E.K.; Materials - N.H.S., A.G., G.T., S.K., A.A., E.K.; Data Collection and/or Processing - N.H.S., Ş.Ş., A.G., G.T., S.K., A.A., E.K.; Analysis and/or Interpretation - A.G., G.T.; Literature Review - N.H.S., S.K., A.A., E.K.; Writer - N.H.S., Ş.Ş., A.G.; Critical Review - Ş.Ş., G.T.

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Yazarlar herhangi bir çıkar çatışması bildirmemişlerdir.

Hakem değerlendirmesi: Dış bağımsız.

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Hasta Onamı: Yazılı hasta onamı bu çalışmaya katılan hastalardan alınmıştır.

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References

1. Marsden D. Spasticity. In: Berry H, Hamilton E, Goodwill J (eds). Rheumatology and Rehabilitation. 2. edition. London: Croom Helm 1983. 197-206.
2. Young RR. Hypertonia: Diagnosis and management. In: Lazar RB (ed). Principles of Neurologic Rehabilitation. New-York: Mc Graw-Hill. 1998: 329-34.
3. Ward AB, Kadies M. The management of pain in spasticity. Disability and Rehabilitation 2002; 24: 443-53. [CrossRef]
4. Wassef MR. Interadductor approach to obturator nerve blockade for spastic conditions of adductor thigh muscles. Reg Anesth 1993; 18: 13-7.
5. Gürkan Y, Tekin M. Ultrasonografi rehberliğinde rejyonal anestezi. Kocaeli 2011: 13-28.
6. Ashworth B. Preliminary trial of Carisoprodol in multipl sclerosis. Practitioner 1964; 192: 540-2.
7. Akkaya T, Unlu E, Alptekin A, Gumus HI, Umay E, Cakci A. Neurolytic phenol blockade of the obturator nerve for severe adductor spasticity. Acta Anaesthesiol Scand 2010; 54: 79-85. [CrossRef]
8. Viel E, Pellas F, Ripart J, Pelissier J, Eledjam JJ. Peripheral neurolytic blocks and spasticity. Ann Fr Anesth Reanim 2005; 24: 667-72. [CrossRef]
9. Labat G (ed). Regional Anesthesia, Its technic and clinical application. 2. edition. Philadelphia: WB Saunders, 1928: 286-7.
10. On AY, Kirazlı Y, Kısmalı B, Akşit R. Mechanisms of action of phenol block and botulinus toxin type A in relieving spasticity: An electrophysiological investigation and follow-up. Am J Phys Med Rehabil 1999; 78: 344-9. [CrossRef]
11. Wolf JH, English AW. Muscle spindle reinnervation following phenol block. Cells Tissues Organs 2000; 166: 325-9. [CrossRef]
12. Kong KH, Chua KS. Outcome of obturator nerve block with alcohol for the treatment of hip adductor spasticity. Int J Rehabil Res 1999; 22: 327-9. [CrossRef]
13. Viel EJ, Perennou D, Ripart J, Pelissier J, Eledjam JJ. Neurolytic blockade of the obturator nerve for intractable spasticity of adductor thigh muscles. Eur J Pain 2002; 6: 97-104. [CrossRef]
14. Trainer N, Bowser BL, Dahm L. Obturator nerve block for painful hip in adult cerebral palsy. Arch Phys Med Rehabil 1986; 67: 829-30.
15. Yadav SL, Singh U, Dureja GP, Singh KK, Chaturvedi S. Phenol block in the management of spastic cerebral palsy. Indian J Pediatr 1994; 61: 249-55. [CrossRef]
16. Soong J, Schafhalter-Zoppoth I, Gray AT. Sonographic imaging of the obturator nerve for regional block. Reg Anesth Pain Med 2007; 32: 146-51. [CrossRef]
17. Helayel PE, da Conceição DB, Pavei P, Knaesel JA, de Oliveira Filho GR. Ultrasound-guided obturator nerve block: a preliminary report of a case series. Reg Anesth Pain Med 2007; 32: 221-6. [CrossRef]
18. Manassero A, Bossolasco M, Ugues S, Palmisano S, De Bonis U, Coletta G. Ultrasound-guided obturator nerve block: interfascial injection versus a neurostimulation-assisted technique. Reg Anesth Pain Med 2012; 37: 67-71. [CrossRef]
19. Abrahams MS, Aziz MF, Fu RF, Horn JL. Ultrasound guidance compared with electrical neurostimulation for peripheral nerve block: a systematic review and meta-analysis of randomized controlled trials. Br J Anaesth 2009; 102: 408-17. [CrossRef]