

# Obstetric brachial plexus injury

## Knowledge among health care providers in Saudi Arabia

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### ABSTRACT

**الأهداف:** لتقييم المعرفة الأساسية لإصابة الضفيرة العصبية التوليدية بين أطباء التوليد وأطباء الأطفال، والعلاج الفيزيائي / المهني في المستشفيات الرئيسية في الرياض. كنا نهدف إلى تحديد ما إذا كانت المعرفة غير كافية هي السبب وراء الإحالات المتأخرة إلى عيادة اليد.

**الطريقة:** هذه الدراسة عبارة عن استبانة مستعرضة أجريت في 5 مستشفيات رئيسية في الرياض خلال الفترة من يونيو 2015م وأغسطس 2015م. أعطى الاستبيان من 6 أسئلة (الاختبار من متعدد الأسئلة المغلقة) لأطباء التوليد وأطباء الأطفال، وأخصائي العلاج الوظيفي والفيزيائي في هذه المستشفيات المختارة. تم تصنيف الدرجة الإجمالية من 6 على أنها جيدة إذا كانت النتيجة 5-6 وكافية إذا كانت النتيجة 3-4 وغير كافية المعرفة إذا كانت النتيجة أقل من 3. تم تحليل البيانات مع اختبار كاي، وفisher، وأنوفا، واختبارات Post-hoc.

**النتائج:** شارك في الدراسة ما مجموعه 323 شخصا. أما بالنسبة للوظائف، فقد تم تسجيل أفضل نتيجة متوسطة (لجميع الأسئلة الستة) من قبل الاستشاريين وكانت النتيجة 2.95 من 6 فقط. بالنسبة للمستشفيات، وسجل مستشفى الرابع أفضل مؤشر متوسط (2.99). لم تكن النتائج المتوسطة تختلف اختلافا كبيرا بين التخصصات المختلفة.

**الخاتمة:** يبدو أن المعرفة غير الكافية سبب الإحالة المتأخرة لحالات إصابة الضفيرة العصبية التوليدية إلى عيادات اليد في الرياض بالمملكة العربية السعودية

**Objectives:** To assess the basic knowledge on obstetric brachial plexus injury among obstetricians, pediatricians, and physio-/occupational therapists in major hospitals in Riyadh. We aimed to identify if inadequate knowledge is the reason behind delayed referrals to the Hand Clinic.

**Methods:** This is a cross-sectional questionnaire-based study conducted at 5 major hospitals in Riyadh, Saudi Arabia between June 2015 and August 2015. A questionnaire

of 6 questions (multiple choice closed-ended questions) was given to obstetricians, pediatricians, and physio-/occupational therapists' in these selected hospitals. The total score out of 6 was categorized as good, adequate, and inadequate knowledge if the score is 5-6, 3-4, and less than 3; respectively. The data were analyzed with Chi-square, fisher exact, Analysis of Variance, and Post-hoc tests where appropriate.

**Results:** A total of 323 subjects participated in the study. For positions, the best mean score (for all 6 questions) was scored by consultants and the score was only 2.95 out of 6. For hospitals, Hospital IV scored the best mean score (2.99). The mean scores were not significantly different between different specialties.

**Conclusion:** Inadequate knowledge seems to be a reason for delayed referrals of cases of obstetric brachial plexus injury to Hand Clinics in Riyadh, Saudi Arabia.

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Obstetric brachial plexus injury (OBPI) is an injury to the roots of the brachial plexus (C5, C6, C7, C8, and T1 roots) from traumatic delivery. The incidence averages 1 per 1000 live births with permanent disabilities reaching 20-30% of cases.<sup>1</sup> Most cases result from shoulder dystocia during the delivery of babies with cephalic presentation. The baby is usually macrosomic: the head is out but one shoulder is stuck behind the pubic ramus; and the obstetrician pulls on the head with significant force; leading to the stretch, rupture or avulsion of the roots of the brachial plexus. With the initial force of pull, the upper roots (C5,6,7) are injured leading to upper (also known as Erb's) palsy. With greater forces, the injury continues to the lower roots leading to total palsy (involving C5, C6, C7, C8 and T1 roots). Isolated lower palsy (also known as Klumpke's palsy and involves only the C8 and T1 roots) requires hyper-abduction of the arm. Theoretically, this may occur with breech delivery with failure of bringing the arms to the side of the body. This is not seen in modern obstetric practice and hence Klumpke's palsy is generally seen only in non-obstetric cases.<sup>2</sup>

Infants with OBPI are encountered first by obstetricians and pediatricians. These 2 first-line health care providers usually refer the infant for physiotherapy. The early referral (during the neonatal period) to physiotherapy department and the early start (at 2-3 weeks after birth) of physiotherapy exercises are mandatory to prevent joint contractures. Referral of the patient with OBPI to the hand surgeon (at the brachial plexus clinic) should also be carried out during the neonatal period. The obstetric brachial plexus clinic is multidisciplinary and assessment of the motor recovery is carried out with regular follow-up utilizing specially designed data sheets.<sup>3</sup> Although there are no Level I-III studies, the consensus in the literature is that infants who have poor spontaneous motor recovery will benefit from exploration and reconstruction of the brachial plexus using nerve grafts and nerve transfers.<sup>4,5</sup>

The timing of surgery varies from one center to another; and depends on other factors such as the type of palsy, the presence of Horner's sign (a poor prognostic sign), and evidence of root avulsion on MRI or nerve conduction studies. Infants with total palsy and Horner's sign are best treated with early (1-3 months of age) nerve grafting; so, that the axons would reach the intrinsic muscles of the hand at an appropriate time before permanent muscle wasting. The timing for surgery in infants with Erb's palsy may be delayed until 3-12 months of age.<sup>6-8</sup> One major problem in the management of OBPI in Saudi Arabia is the delayed referral to the obstetric brachial plexus clinic (personal

communication with the director of the first OBPI clinic in Saudi Arabia).<sup>3</sup> One potential reason is the lack of knowledge among the concerned health care providers (obstetricians, pediatricians, and physio/occupational therapists) in Saudi Arabia. In the current paper, we designed a questionnaire to assess the basic knowledge of OBPI among these concerned health care providers in 5 major hospitals in Riyadh. The results are presented and discussed. We aimed to find if lack of knowledge is the reason behind the delayed referral to OBPI Clinic.

**Methods.** Ethical approval was obtained from King Abdullah International Medical Research Center (KAIMRC), Riyadh, Saudi Arabia and the study was approved according to the principles of Helsinki Declaration. In each hospital, an additional authorization was also provided by the hospital administration before distribution of questionnaires. There was no need for informed consent because the questionnaire was anonymous with no demands for personal information (convenience sampling technique). A Medline search did not reveal similar studies in the literature; hence, comparison of our results to others was not possible.

This study used a cross-sectional questionnaire-based approach that took place in 5 major hospitals in Riyadh, Saudi Arabia between June and August 2015. The names of the hospitals will be kept anonymous by naming the hospitals as numbers I to V. All hospitals that were included in the study were major hospitals and had referral systems to the Hand Clinic. This type of study has been chosen due to its ability to analyze data collected on a group of subjects at one time rather than over a period of time, which was the best study to achieve the objectives of this study. All residents, registrars, senior registrars and consultants working in both pediatric and obstetrics/gynecology departments in major hospitals in Riyadh as well as staff in the rehabilitation centers of the hospitals were included.

**Data collection.** The questionnaire (Table 1) consisted of 6 questions, all of which are multiple choice closed-ended questions. These questions were aimed to assess the knowledge of OBPI and timing for referral to the hand surgery among obstetricians, pediatricians and physiotherapists and to compare their knowledge of the injury. The questionnaire has been written by the principal investigator. The validity of the content of the questionnaire was carried out by asking 3 experts in the field to compute the number of questions deemed to test basic knowledge on OBPI. All 3 experts computed that 100% of questions were testing the basic knowledge on OBPI (namely, average

**Table 1** - The questionnaire and the overall percentage of correct answers.

Questions	n	(%)
<i>Q-1: Types of obstetric brachial plexus palsy</i>		
A. Upper (Erb's), Lower (Klumpke's) and total palsy types are all frequently seen in obstetric cases	228	(70.6)
B. Only upper palsy is seen in obstetric cases since the lower and total types are seen only in non-obstetric cases	77	(23.8)
C. *Upper and total palsies only (lower palsy is generally seen in non-obstetric cases)	18	(5.6)
<i>Q-2: The most important cause of obstetric brachial plexus palsy is:</i>		
A. *Difficult labor with shoulder dystocia	300	(92.9)
B. Abnormal intrauterine pressure in the 3 <sup>rd</sup> trimester	15	(4.6)
C. Cord around the proximal part of the limb	8	(2.5)
<i>Q-3: The best timing of referral of the patient with obstetric brachial plexus palsy to the physiotherapy department is:</i>		
A. *During the neonatal period	197	(61.1)
B. Between 1-3 months of age	88	(27.2)
C. Three months after birth	24	(7.4)
D. One year after birth	14	(4.3)
<i>Q-4: The best timing of starting physiotherapy in patients with obstetric brachial plexus palsy is:</i>		
A. *2-3 weeks after birth	165	(51.1)
B. Between 1-3 months of age	106	(32.8)
C. 3-12 months of age	40	(12.4)
D. After one year of age	12	(3.7)
<i>Q-5: The best timing of referral of the patient with obstetric brachial plexus palsy to the hand surgeon is:</i>		
A. *During neonatal period	53	(16.4)
B. Between 1-3 months of age	52	(16.1)
C. 3-12 months of age	107	(33.1)
D. After 1 year of age	111	(34.4)
<i>Q-6: Patients with obstetric brachial plexus palsy and who do not show good spontaneous motor recovery of the affected limb, surgery to the brachial plexus is recommended by hand surgeons at the age of:</i>		
A. During neonatal period	11	(3.4)
B. †Between 1-3 months of age	50	(15.5)
C. †3-12 months of age	74	(22.9)
D. After one year of age	188	(58.2)

\*correct answers, †has 2 correct answers. Each of the remaining questions has only one correct answer

congruency percentage of 100%). The same experts were also asked to grade the relevance of each question on a 4-point scale (1= not relevant; 2= somewhat relevant; 3= relevant; 4= very relevant). All 3 experts scored all questions as grade of 4 (namely, content validity index for individual items, I-CVI, of 1). The sample size was calculated with a confidence interval of 95% and a margin of error of 5%. The population size was considered to be infinite (20,000); since we were not able to precisely count the total population of pediatricians, obstetricians and physiotherapists in the 5 hospitals. The response distribution was estimated to be 50%; meaning that we assumed that 50% of these health-care providers have adequate knowledge on OBPI and 50% have no adequate knowledge about OBPI. The 50 % response distribution was used because there were no similar studies in the world literature to determine the exact response distribution. Using

50% as a response distribution provides the highest number of sample size. The estimated ideal sample size was 377 participants in all 5 hospitals. In our study, a total of 323 participants answered the questionnaire. The questionnaire was distributed during the morning meetings of the concerned specialties; and collected 10 minutes later.

Data entry and analysis were carried out by SPSS version 21 software (SPSS Inc., Chicago, IL, USA), inferential statistics by Analysis of Variance and Post-Hoc tests ( $p < 0.05$  was considered significant) and descriptive statistics by percentages and frequencies. The questionnaire consists of 6 items; each item analyzed as either right or wrong answer. Each of the 6 questions have one correct answer except question number 6 on the timing of surgery of the brachial plexus which had 2 correct answers. Although some may consider this inappropriate for multiple choice question (MCQ),

having 2 correct answers provides all participants an equal extra advantage of choosing the correct answer. As mentioned in the introduction, the timing varies according to the types of palsy and hence answers B and C are considered as correct for question number 6. The total score out of 6 was categorized as A) good knowledge if score is 5-6, B) adequate knowledge if score is 3-4, and C) inadequate knowledge if score is less than 3. This categorization was chosen because we considered it as an MCQ exam. A score of 5-6 means the candidate had passed with a high grade of over 83%; indicating good knowledge. In contrast, a score of less than 3 means a clear failure (less than 50%); indicating an inadequate knowledge. The intermediate group would score 50-67%.

**Results.** A total of 323 subjects participated in the study. There were 140 (43.3%) pediatricians, 107 (33.1%) obstetricians and 76 (23.5%) physio/occupational therapists. Out of 323 subjects, there were 78 (24.1%) Consultants, 31 (9.6%) Senior Registrars, 33 (10.2%) Registrars, 51 (15.8%) Residents, 14 (4.3%) medical interns and 116 (35.9%) missing (“missing” means that the participant did not specify the level in the questionnaire).

Table 1 shows the percentages of the correct answers among all participants. Only 5.6% selected the correct answer on the types of palsy (Question 1); indicating a

poor basic knowledge. In contrast, the majority (92.9%) knew that shoulder dystocia is the main cause of injury (Question 2). Over 50% of participants knew that the early referral to physiotherapy and the early start of exercises are the best choices (Questions 3 and 4). The results of the last 2 questions (Questions # 5, and 6) also indicated poor knowledge regarding the early referral to the hand surgeon (only 16.4% of participants had the correct answer for Question #5), and regarding the timing of surgery (only 38.4% of participants chose one of the two correct answers for Question #6).

Tables 2-4 show the difficulty index, the discrimination index, and the distracter efficiency of the questionnaire. One question was considered easy and two questions were considered difficult (Table 3). The discriminative power was excellent for four questions and acceptable for the remaining two questions (Table 4).

Table 5 shows the overall results as mean total scores of correct answers. Among specialties, pediatricians had the best mean total score (2.83) of correct answers, but the p=0.059 did not reach significance. By Post-Hoc test, consultants did significantly better than residents, and Hospital IV did significantly better than Hospital II.

**Discussion.** There are no similar studies in the world literature and hence it is difficult to compare the knowledge on OBPI in Saudi healthcare providers to other countries. As we mentioned on our methodology,

**Table 2 -** Difficulty index, discrimination index , distracter efficiency , and distracter analysis.

Item No.	Difficulty index	Discrimination index	Distracter efficiency (%)	Group	Distracter analysis n (%)			
					A	B	C	D
Q-1: Types of obstetric brachial plexus palsy	5.6	0.01	66.6	Lower	65 (80.2)	13 (16.0)	3 (3.7)	0 (0.0)
				Upper	60 (74.1)	17 (21.0)	4 (4.9)	0 (0.0)
Q-2: The most important cause of obstetric brachial plexus palsy is:	92.9	0.11	0.0	Lower	70 (86.4)	7 (8.6)	4 (4.9)	0 (0.0)
				Upper	17 (21.0)	44 (54.3)	11 (13.6)	9 (11.1)
Q-3: The best timing of referral of the patient with obstetric brachial plexus palsy to the physiotherapy department is:	61.0	0.74	66.6	Lower	17 (21.0)	44 (54.3)	11 (13.6)	9 (11/1)
				Upper	77 (95.1)	3 (3.7)	0 (0.0)	1 (1.2)
Q-4: The best timing of starting physiotherapy in patients with obstetric brachial plexus palsy is:	51.1	0.78	66.6	Lower	7 (8.6)	45 (55.6)	23 (28.4)	6 (7.4)
				Upper	70 (86.4)	11(13.6)	0 (0.0)	0 (0.0)
Q-5: The best timing of referral of the patient with obstetric brachial plexus palsy to the hand surgeon is:	16.4	0.43	100.0	Lower	2 (2.5)	8 (9.9)	28 (34.6)	43 (53.1)
				Upper	37 (45.7)	18 (22.2)	19 (23.5)	7 (8.6)
Q-6: Patients with obstetric brachial plexus palsy and who do not show good spontaneous motor recovery of the affected limb, surgery to the brachial plexus is recommended by hand surgeons at the age of:	38.4	0.64	66.6	Lower	2 (2.5)	6 (7.4)	3 (3.7)	70 (86.4)
				Upper	7 (8.6)	23 (28.4)	38 (46.9)	13 (16.0)

knowledge was considered “good” if the score of correct answers is 5-6 and was considered “inadequate” if the mean score is less than 3. Table 5 showed that the best mean score for all categories (by specialty and position) was only 2.95 (the best score was for consultants). The fact that consultants had the best score also confirmed that the questionnaire was valid in testing the knowledge on OBBI.

**Table 3 -** Interpretation of questions (Q1 to Q6) by using difficulty index.

Difficult index (%)	Category of item	Number of items
<30	Difficult	Q1, Q5
30-70	Acceptable	Q3, Q4, Q6
>70	Easy	Q2

**Table 4 -** Interpretation of questions (Q1 to Q6) by using discrimination index.

Discrimination index	Discriminative power	Number of items
≥0.35	Excellent	Q3, Q4, Q5, Q6
0.2 to 0.34	Good	
>0 to 0.2	Acceptable	Q1, Q2
0	Cannot Discriminate	
<0 to -1	Poor	

Our main aim was to identify the reason for late referrals of OBPI cases to the Hand clinic. Table 1 showed that over 50% of participants knew the importance of early referral to physiotherapy. In contrast, only 16.4% of the participants knew the importance of early referral to the Hand Clinic. Following nerve repair, the new axons advance from the site of repair to distal target muscles at a mean rate of 1 mm per day. The longer the muscle denervation period the less responsive are the motor end plates to the upcoming axons. In infants with total palsy and evidence of lower root avulsion, early surgery is mandatory because the intrinsic muscles are the farthest from the injury site in the neck.

In the past, all infants with OBPI were initially treated conservatively. At age 2-5 years, those who had poor spontaneous motor recovery (resulting in significant functional disabilities) were referred to orthopedic surgeons to do salvage reconstructive procedures such as tendon transfers and osteotomies. The field of microsurgery has advanced greatly over the last two decades and has advanced from nerve grafts to nerve transfers.<sup>6</sup> The results are excellent and consistent.<sup>5,9</sup> However, it is obvious that such knowledge is still lacking to the primary health care providers for OBPI.

There are some limitations to our study. Our main aim was to investigate the reason for delayed referrals of OBPI patients to the surgical clinic. Yet, some of the

**Table 5 -** Comparison between the total scores of correct answers for different positions, different hospitals and different specialties.

Variables	N	Mean	Std. Deviation	Median	Minimum	Maximum	P-value (ANOVA)*
<i>Specialties</i>							0.059
Obstetrics	107	2.53	1.17	3.0	0	5	
Pediatrics	140	2.83	1.16	3.0	1	5	
Rehabilitation	76	2.50	1.15	2.5	0	5	
Intern	14	2.71	1.14	3.0	1	5	
Resident	51	2.20 <sup>†</sup>	1.30	2.0	0	5	
<i>Positions</i>							0.010
Registrar	33	2.67	1.14	3.0	1	5	
Senior Registrar	31	2.74	0.96	3.0	1	5	
Consultant	78	2.95 <sup>†</sup>	1.09	3.0	1	5	
Hospital I	28	2.71	1.21	3.0	1	5	
Hospital II	104	2.47 <sup>‡</sup>	1.17	2.0	0	5	
<i>Hospitals</i>							0.046
Hospital III	38	2.71	1.39	2.5	0	5	
Hospital IV	74	2.99 <sup>‡</sup>	0.95	3.0	0	5	
Hospital V	79	2.53	1.15	3.0	1	5	

\*By analysis of variance (ANOVA),  $p < 0.05$  (indicating significance) for positions and hospitals; and not for specialties. <sup>†</sup>By Bonferroni Post-hoc Test, consultants scored significantly better (P was less than 0.05) than residents. <sup>‡</sup>By Dennett T3 Post-hoc Test, Hospital IV scored significantly better (P was less than 0.05) than Hospital II



questions (such as question #1) only tests basic knowledge which cannot be assumed as a cause of delay. Another limitation is that the correct answers for questions # 5 and 6 are based on the experience of senior surgeons in the field and this “expert opinion” has a poor level of evidence (Level V) from the scientific point of view.<sup>4</sup> In fact, a systematic review showed the lack of strong evidence regarding the effectiveness of primary surgery in OBPI.<sup>10</sup> This back-ground could be the reason of many not answering question # 6 correctly. A third limitation of the study is that the questionnaire did not investigate the physicians and carers’ knowledge of the availability of the multidisciplinary OBPI clinic; and this could be another cause of delay in referral. Finally, we did not group the physicians further according to age to see if it has a role in the average knowledge score.

In conclusion, we showed that there is generally inadequate knowledge regarding the basics of OBPI. The worst part was the general lack of knowledge regarding the importance of early referrals to the Hand Clinic and benefit of surgery. This clearly explains the late referrals to the hand Clinic. Education of Front-Line care providers for OBPI in the form of lectures is needed in Saudi Arabia. Future research should be directed to repeating the study after an educational program as well as conducting similar studies in other countries for comparison. A qualitative study on parents of a group of OBPI patients as well as those who are involved in their care may also be undertaken by asking direct questions and then analyze the responses.

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