inferior to the coracoid process. The 3D measures were based on gelenoid and humerus models, acquired through manual segmentation.

**Results.**—The impaired gelenoid demonstrated posterior version (−7.0°, p = 0.02) with an accompanying inferior version of the same magnitude (−6.5°, p = 0.02). The humeral head migration was posterior, inferior, and medial (−3.4, −3.6, −3.2 mm, p < 0.05). Where direct comparisons could be made, there was good correspondence between 2D and 3D, yet the 3D measures demonstrated lower variability and better inter-rater reliability (ICC = 0.97–0.98 versus 0.66–0.73).

**Discussion.**—These novel findings regarding the inferior humeral migration and inferior gelenoid version should be taken into account when planning interventions for children with OBPP. Specifically, given the multi-directional nature of gelenoid-humeral deformation in OBPP, consideration should be given to adapting surgical techniques in order to provide a full 3D correction of the gelenoid-humeral deformation, which may provide better functional outcomes.

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**CO33-004-e**

**Three-dimensional humeral morphological changes in children with obstetrical brachial plexus palsy**

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**Keywords:** Obstetrical brachial plexus palsy; Humeral head; Three-dimensional analysis

**Background.**—Obstetrical brachial plexus palsy (OBPP) is a common birth injury, resulting in severe functional losses. Little is known about how OBPP affects the 3D humeral morphology. Thus, the purpose of this study was to measure the 3D humeral architecture in children with unilateral OBPP.

**Methods.**—Thirteen children (age = 11.8 ± 3.3, 4F/9 M, Mallet score = 15.1 ± 3.0) participated in this IRB-approved study. A three-dimensional T1-weighted gradient-recalled-echo image set (resolution = 0.55-0.63mm2, slice_thickness = 1.2 mm, imaging time = 4 min 22 sec) was acquired for both upper limbs (impaired/unimpaired) with the subject supine in a 3 T Siemens MRI (Verio, Germany). From these image sets 3D humeral models were created in order to measure humeral size, version, and inclination.

**Results.**—The humeral head (affected side) was less retroverted (−6.4°) and in declination (medial humeral head pointed anteriorly and inferiorly), relative to the unaffected side. Osseous atrophy was present in all three dimensions and affected the entire humerus. The inter-rater reliability of all parameters was excellent (ICC = 0.96–1.00).

**Discussion.**—This study is the first to evaluate 3D humeral shape changes in OBPP and the results indicated that planning for humeral or gelenoid-humeral surgeries in OBPP should be guided by 3D, subject-specific gelenoid-humeral shape analyses. The reduced retroversion is likely an osseous adaptation, which may help maintain gelenoid-humeral congruency by partially compensating for the internal rotation of the arm, the typical posture reported which may help maintain glenoid-humeral congruency by partially compensating for the internal rotation of the arm, the typical posture reported.

**References**


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**CO33-006-e**

**Effect of video-guidance on passive movement: Could it be useful for cerebral palsy rehabilitation?**

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**Keywords:** Cerebral Palsy; Action-observation; Motor cortex; Functional MRI; Passive movement

**Aim.**—The aim of this functional magnetic resonance imaging (fMRI) study was to examine brain activation in patients with hemiplegic cerebral palsy (HCP) during motor imagery of a simple hand movement.

**Method.**—Eighteen patients with clinical HCP (fourteen male, mean age 14 years and 2 months, aged 6 years 10 months to 20 years 10 months) participated in this study. Using block design, brain activation following MI of a simple opening-closing hand movement performed by either the affected or unaffected hand was examined.

**Results.**—Seventeen fMRI dataset were analyzed. During MI of the unaffected hand, activation included bilateral (Supplementary Motor Area), SMA bilateral premotor cortices, ipsilesional primary and second somatosensory areas, bilateral inferior parietal cortices, contralesional middle frontal and bilateral inferior frontal areas. During MI of the affected hand, activation included ipsilesional primary and second somatosensory area, bilateral inferior parietal lobes and ipsilesional superior parietal lobes and activation in the ipsilesional insular cortex. During both condition of MI, the visual and auditory cortices were activated. MI of the unaffected hand compared to MI of the affected hand activated more strongly the bilateral SMA, the ipsilesional primary motor cortex, the ipsilesional primary somatosensory cortex, the contralesional inferior frontal gyrus and middle frontal gyrus.

**Conclusion.**—Brain activations during MI of the affected and unaffected hand share different pattern of brain activation for children with HCP. Compared to the unaffected hand, MI of the affected hand seems to be difficult for HCP and activated less brain regions as expected in healthy people. Our study gives neural findings to indicate that MI of the affected hand for children with HCP is difficult.

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during passive movement with simultaneous observation of simple hand movement. 

Method.– Eighteen patients with clinical HCP (fifteen males, mean age 14 years and 2 months, aged 6 years 10 months to 20 years 10 months) participated in the study. Using fMRI block design, brain activation following passive simple opening-closing hand movement of either the paretic or nonparetic hand with simultaneous observation of a similar movement performed by either the left or right hand of an actor was examined.

Results.– Passive movement of the paretic hand performed simultaneously to the observation of congruent movement (“anatomic imitation”) activated more “higher motor areas”, including contralateral pre-supplementary motor area, superior frontal gyrus (extending to premotor cortex), and superior and inferior parietal regions than non video-guided passive movement of the paretic hand. Passive movement of the paretic hand recruited more ipsilesional sensorimotor areas compared to passive movement of the non paretic hand.

Conclusion.– Our study showed in HCP that the combination of observation of congruent hand movement simultaneously to actual passive movement of the paretic hand recruits more higher motor areas than nonvideo-guided passive movement of the paretic hand. Our study gives neural findings to propose video-guided passive movement of paretic hand in CP.

Further reading


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Effectiveness of an interactive robot for the rehabilitation of the upper limb in children with cerebral palsy: A randomised single-blind controlled trial
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Keywords: Robot-assisted therapy,upper extremity; Child; Cerebral palsy

Introduction.– Several pilot studies have evoked the interest of robot-assisted therapy (RAT) in children with cerebral palsy (CP) [1]. The purpose of this first single-blind randomised controlled trial was to assess, in children with CP, the effectiveness of RAT combined with conventional therapy (CT), in comparison to CT only.

Materials and methods.– Sixteen children with CP were randomised into two groups. Eight children performed five CT sessions per week during 8 weeks (control group). Eight other children completed three CT sessions and two RAT sessions per week during 8 weeks (Robotic group). Each session lasted 45 mins. Throughout each RAT session, the patient had to reach several targets consecutively with the REAplan. The REAplan is a distal effector that allows displacements of the upper limb in the horizontal plane. The assistance provided by the REAplan was based on the patient’s performance. A blinded assessment was performed before and after the intervention, with respect to the three domains of the international classification of functioning, disability and health: the body functions and structures (upper limb kinematics, Box and Block test, QUEST, strength and spasticity), the activities (Abilhand-Kids, PEDI) and the participation (MHA-VIE).

Results.– During each RAT session, patients performed 744 movements on average with the REAplan. The smoothness, straightness and the reproducibility of upper limb movements (p < 0.01) were significantly improved in the robotic group. The manual dexterity of the upper limb, assessed by the Box and Block test, was also improved in these children (p = 0.04). All the other variables did not show any difference between groups.

Conclusion.– This single-blind randomised controlled trial provides the first evidence that RAT is effective in children with CP. Future studies should investigate the long-term efficacy of this therapy.

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Communications affichées
Version française

P083-f
La paralysie obstétricale du plexus brachial en milieu de médecine physique et rééducation fonctionnelle
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Mots clés : Paralysie obstétricale du plexus brachial ; Devenir fonctionnel

Objectif.– Déterminer les caractéristiques épidémiologiques, cliniques et évolutives des paralysies obstétricales du plexus brachial (POPB) en milieu de rééducation.


Résultats.– Parmi 104 dossiers, 74 seulement ont été retenus (30 dossiers manquaient de données). La population d’étude était représentée par 38 filles (51,4 %) et 36 garçons (48,6 %) avec une moyenne d’âge de 63 jours [extrêmes de cinq jours à 30 mois]. Les deux cotés étaient atteints d’une manière égale. La paralysie était haute dans 66,2 % des cas, et complète dans 33,8 % des cas. La dystostie des épaules a compliqué 27 % des accouchements. Le poids de naissance moyen était de 3921 g.

Une prise en charge adaptée a été instaurée pour chaque cas. Pour les nourrissons ayant consulté tôt (n = 50), la rééducation fonctionnelle a débuté après l’âge de 30 jours avec une durée moyenne de 13 mois. À trois mois de vie, une récupération totale du biceps brachial a été notée dans 6 % des cas, et partielle (cotation ≥ 3) dans 66 % des cas. Devant l’absence de récupération musculaire, l’EMG a été réalisé (16 % des cas). Une chirurgie nerveuse a été pratiquée dans 14 % des cas. Pour la population restante (n = 24), la chirurgie des séquelles a été envisagée dans 8,3 % des cas.

Discussion.– La POPB est une des principales complications en période néonatale. Sa prise en charge est multidisciplinaire, son traitement repose essentiellement sur la rééducation qui doit être précoce, adaptée et supervisée.

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P083-e
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Keywords: Obstetric brachial plexus palsy; Functional outcome

Objective.– To determine the epidemiological and clinical features of patients with obstetric brachial plexus palsy (OBPP)