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Diagnostic et prise en charge médicale des douleurs de hanches des adultes paralysés cérébraux

Carole Le Roux

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UNIVERSITE DE MONTPELLIER
FACULTE DE MEDECINE MONTPELLIER-NIMES

THESE

Pour obtenir le titre de
DOCTEUR EN MEDECINE

Présentée et soutenue publiquement

Par

Carole LE ROUX

Le jeudi 8 avril 2021

DIAGNOSTIC ET PRISE EN CHARGE MEDICALE DES
DOULEURS DE HANCHES DES ADULTES PARALYSES
CEREBRAUX

Directrice de thèse : Dr Flavia COROIAN

JURY

Présidente : Pr Isabelle LAFFONT

Assesseurs : Pr Arnaud DUPEYRON

Pr Bertrand COULET

Dr Flavia COROIAN

UNIVERSITE DE MONTPELLIER
FACULTE DE MEDECINE MONTPELLIER-NIMES

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PARALYSES CEREBRAUX

Directrice de thèse : Dr Flavia COROIAN

JURY

Présidente : Pr Isabelle LAFFONT

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| DELAPORTE Eric | Maladies infectieuses ; maladies tropicales |
| DEMOLY Pascal | Pneumologie ; addictologie |
| DOMERGUE Jacques | Chirurgie viscérale et digestive |

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| SOTTO Albert | Maladies infectieuses ; maladies tropicales |
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Génétique

VANDE PERRE Philippe

Bactériologie-virologie ; hygiène hospitalière

YCHOU Marc

Cancérologie ; radiothérapie

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Hématologie ; transfusion

ASSENAT Éric

Gastroentérologie ; hépatologie ; addictologie

AVIGNON Antoine

Nutrition

AZRIA David

Cancérologie ; radiothérapie

BAGHDADLI Amaria

Pédopsychiatrie ; addictologie

BLANC Pierre

Gastroentérologie ; hépatologie ; addictologie

BORIE Frédéric

Chirurgie viscérale et digestive

BOURDIN Arnaud

Pneumologie ; addictologie

CAMBONIE Gilles

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CAMU William

Neurologie

CANOVAS François

Anatomie

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Anatomie

CARTRON Guillaume

Hématologie ; transfusion

CAYLA Guillaume

Cardiologie

CHANQUES Gérald

Anesthésiologie-réanimation et médecine péri-opératoire

CORBEAU Pierre

Immunologie

COULET Bertrand

Chirurgie orthopédique et traumatologique

CUVILLON Philippe

Anesthésiologie-réanimation et médecine péri-opératoire

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DE TAYRAC Renaud

Gynécologie-obstétrique, gynécologie médicale

DE VOS John

Histologie, embryologie et cytogénétique

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| DEMARIA Roland | Chirurgie thoracique et cardio-vasculaire |
| DEREURE Olivier | Dermatologie - vénéréologie |
| DROUPY Stéphane | Urologie |
| DUCROS Anne | Neurologie |
| DUPEYRON Arnaud | Médecine physique et de réadaptation |
| FESLER Pierre | Médecine interne ; gériatrie et biologie du vieillissement, médecine générale, addictologie |
| GARREL Renaud | Oto-rhino-laryngologie |
| GENEVIEVE David | Génétique |
| GUILLAUME Sébastien | Psychiatrie d'adultes ; addictologie |
| GUIU Boris | Radiologie et imagerie médicale |
| HAYOT Maurice | Physiologie |
| HOUEDE Nadine | Cancérologie ; radiothérapie |
| KLOUCHE Kada | Médecine intensive-réanimation |
| KOENIG Michel | Génétique |
| KOUYOUMDJIAN Pascal | Chirurgie orthopédique et traumatologique |
| LAFFONT Isabelle | Médecine physique et de réadaptation |
| LAVABRE-BERTRAND Thierry | Histologie, embryologie et cytogénétique |
| LAVIGNE Jean-Philippe | Bactériologie-virologie ; hygiène hospitalière |
| LE MOING Vincent | Maladies infectieuses ; maladies tropicales |
| LECLERCQ Florence | Cardiologie |
| MARIANO-GOULART Denis | Biophysique et médecine nucléaire |
| MATECKI Stéfan | Physiologie |
| MORANNE Olivier | Néphrologie |
| MOREL Jacques | Rhumatologie |
| NAVARRO Francis | Chirurgie viscérale et digestive |
| NOCCA David | Chirurgie viscérale et digestive |
| PASQUIE Jean-Luc | Cardiologie |

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| PERNEY Pascal | Médecine interne ; gériatrie et biologie du vieillissement, médecine générale, addictologie |
| PRUDHOMME Michel | Anatomie |
| PUJOL Jean Louis | Pneumologie ; addictologie |
| PURPER-OUAKIL Diane | Pédopsychiatrie ; addictologie |
| ROGER Pascal | Anatomie et cytologie pathologiques |
| TRAN Tu-Anh | Pédiatrie |
| VERNHET Hélène | Radiologie et imagerie médicale |

PU-PH de 2ème classe

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| BOURGIER Céline | Cancérologie; radiothérapie |
| CANAUD Ludovic | Chirurgie vasculaire ; médecine vasculaire (option chirurgie vasculaire) |
| CAPDEVIELLE Delphine | Psychiatrie d'Adultes ; addictologie |
| CLARET Pierre-Géraud | Médecine d'urgence |
| COLOMBO Pierre-Emmanuel | Cancérologie ; radiothérapie |
| COSTALAT Vincent | Radiologie et imagerie médicale |
| DAIEN Vincent | Ophtalmologie |
| DORANDEU Anne | Médecine légale et droit de la santé |
| FAILLIE Jean-Luc | Pharmacologie fondamentale ; pharmacologie clinique ; addictologie |
| FUCHS Florent | Gynécologie-obstétrique ; gynécologie médicale |
| GABELLE DELOUSTAL Audrey | Neurologie |
| GAUJOUX Viala Cécile | Rhumatologie |
| GODREUIL Sylvain | Bactériologie-virologie ; hygiène hospitalière |
| GUILPAIN Philippe | Médecine Interne, gériatrie et biologie du vieillissement; addictologie |
| HERLIN Christian | Chirurgie plastique, reconstructrice et esthétique, brûlologie |
| IMMEDIATO DAIEN Claire | Rhumatologie |
| JACOT William | Cancérologie ; Radiothérapie |
| JEZIORSKI Eric | Pédiatrie |

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| JUNG Boris | Médecine intensive-réanimation |
| KALFA Nicolas | Chirurgie infantile |
| LACHAUD Laurence | Parasitologie et mycologie |
| LALLEMANT Benjamin | Oto-rhino-laryngologie |
| LE QUINTREC DONNETTE Moglie | Néphrologie |
| LETOUZEY Vincent | Gynécologie-obstétrique ; gynécologie médicale |
| LONJON Nicolas | Neurochirurgie |
| LOPEZ CASTROMAN Jorge | Psychiatrie d'Adultes ; addictologie |
| LUKAS Cédric | Rhumatologie |
| MENJOT de CHAMPFLEUR Nicolas | Radiologie et imagerie médicale |
| MILLET Ingrid | Radiologie et imagerie médicale |
| MURA Thibault | Biostatistiques, informatique médicale et technologies de la communication |
| NAGOT Nicolas | Biostatistiques, informatique médicale et technologies de la communication |
| OLIE Emilie | Psychiatrie d'adultes; addictologie |
| PANARO Fabrizio | Chirurgie viscérale et digestive |
| PARIS Françoise | Biologie et médecine du développement et de la reproduction ; gynécologie médicale |
| PELLESTOR Franck | Histologie, embryologie et cytogénétique |
| PEREZ MARTIN Antonia | Chirurgie vasculaire ; médecine vasculaire (option médecine vasculaire) |
| POUDEROUX Philippe | Gastroentérologie ; hépatologie ; addictologie |
| RIGAU Valérie | Anatomie et cytologie pathologiques |
| RIVIER François | Pédiatrie |
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| ROUBILLE François | Cardiologie |
| SEBBANE Mustapha | Médecine d'urgence |
| SIRVENT Nicolas | Pédiatrie |
| SOLASSOL Jérôme | Biologie cellulaire |
| STOEBNER Pierre | Dermato-vénéréologie |

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| SULTAN Ariane | Nutrition |
| THOUVENOT Éric | Neurologie |
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| TUAILLON Edouard | Bactériologie-virologie; hygiène hospitalière |
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| SEGONDY Michel | Bactériologie-virologie ; hygiène hospitalière |

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| BOULLE Nathalie | Biologie cellulaire |
| CACHEUX-RATABOUL Valère | Génétique |
| CARRIERE Christian | Bactériologie-virologie ; hygiène hospitalière |
| CHARACHON Sylvie | Bactériologie-virologie ; hygiène hospitalière |
| FABBRO-PERAY Pascale | Epidémiologie, économie de la santé et prévention |
| GIANSILY-BLAIZOT Muriel | Hématologie ; transfusion |

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| BOUDOUSQ Vincent | Biophysique et médecine nucléaire |
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| BROUILLET Sophie | Biologie et médecine du développement et de la reproduction ; gynécologie médicale |
| COSSEE Mireille | Génétique |
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| LAVIGNE Géraldine | Hématologie ; transfusion |
| LESAGE François-Xavier | Médecine et Santé au Travail |
| MARTRILLE Laurent | Médecine légale et droit de la santé |
| MATHIEU Olivier | Pharmacologie fondamentale ; pharmacologie clinique ; addictologie |

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| PANABIÈRES Catherine | Biologie cellulaire |
| RAVEL Christophe | Parasitologie et mycologie |
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| STERKERS Yvon | Parasitologie et mycologie |
| THEVENIN-RENE Céline | Immunologie |
| <u>MCU-PH de 2^{ème} classe</u> | |
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| CHIRIAC Anca | Immunologie |
| DE JONG Audrey | Anesthésiologie-réanimation et médecine péri-opératoire |
| DU THANH Aurélie | Dermato-vénérologie |
| FITENI Frédéric | Cancérologie ; radiothérapie |
| GOUZI Farès | Physiologie |
| HERRERO Astrid | Chirurgie viscérale et digestive |
| HUBERLANT Stéphanie | Gynécologie-obstétrique ; Gynécologie médicale |
| KUSTER Nils | Biochimie et biologie moléculaire |
| MAKINSON Alain | Maladies infectieuses, Maladies tropicales |
| PANTEL Alix | Bactériologie-virologie ; hygiène hospitalière |
| PERS Yves-Marie | Thérapeutique; addictologie |
| ROUBILLE Camille | Médecine interne ; gériatrie et biologie du vieillissement ; addictologie |
| SZABLEWSKY | Anatomie et cytologie pathologiques |

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| GUGLIELMI Laurence | Sciences biologiques fondamentales et cliniques |
| HENRY Laurent | Sciences biologiques fondamentales et cliniques |
| HERBET Guillaume | Neurosciences |
| LADRET Véronique | Mathématiques appliquées et applications des mathématiques |
| LAINÉ Sébastien | Sciences du Médicament et autres produits de santé |
| LE GALLIC Lionel | Sciences du médicament et autres produits de santé |
| LOZZA Catherine | Sciences physico-chimiques et technologies pharmaceutiques |
| MAIMOUN Laurent | Sciences physico-chimiques et ingénierie appliquée à la santé |
| MOREAUX Jérôme | Science biologiques, fondamentales et cliniques |
| MORITZ-GASSER Sylvie | Neurosciences |
| MOUTOT Gilles | Philosophie |
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| RAYNAUD Fabrice | Sciences du Médicament et autres produits de santé |
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| MOUSTY Eve | SKALLI El Medhi |
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| PEYRON Pierre-Antoine | THIRION Marina |
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| PICOT Marie Christine | VERNES Eric |
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I. PRESENTATION (Français)

La prévalence de la paralysie cérébrale en Europe est de 1,5 à 3 pour 1000 naissances¹. La plupart de ces enfants, y compris ceux aux niveaux de handicap les plus sévères, atteignent l'âge adulte.²⁻⁴

Bien que les douleurs de hanche soient fréquentes dans cette population, il semble pourtant exciter un manque de prise en charge spécifique aux adultes paralysés cérébraux.^{5,6} La majorité des études que l'on trouve dans la littérature porte sur la prise en charge des enfants paralysés cérébraux.

L'incidence des coxalgies chez ces patients est probablement sous-estimée en raison de la difficulté à diagnostiquer et à évaluer leurs douleurs lorsqu'ils présentent des troubles de la communication et/ou troubles cognitifs. C'est souvent le cas des patients aux niveaux GMFCS (Gross Motor Function Classification System) les plus élevés (IV et V) qui sont justement les plus à risque de développer des douleurs de hanche.⁷

Dans le service de Médecine Physique et de Réadaptation du Centre Hospitalier Universitaire de Montpellier, entre 2010 et 2020, nous avons pris en charge 14 patients adultes paralysés cérébraux, de niveaux GMFCS III ou plus, présentant une douleur de hanche.

Notre objectif était d'évaluer l'intérêt d'injections intra-articulaires d'anesthésiques locaux, associées à des injections intra-articulaires de corticoïdes et parfois à des injections de toxine botulique dans les muscles péri-articulaires.

Les résultats de cette étude de cas rétrospective, présentés ci-dessous en anglais, nous ont permis de proposer un arbre décisionnel pour aider à la prise en charge diagnostique et au traitement médical des douleurs de hanche des adultes paralysés cérébraux.

II. INTRODUCTION

The prevalence of cerebral palsy in Europe has been estimated to range from 1,5 to 3 per 1000 live births¹. The prevalence of adults with cerebral palsy is increasing due to the improvement of survival at birth and of life expectancy.

Hip pain is common in adults with cerebral palsy, with an incidence of 36 to 63,1% of patients according to different studies^{2,11}. Its incidence is most likely underestimated, due to difficulties to assess pain in nonverbal or cognitively impaired patients.

Hip pain is often discovered at an already advanced stage and can have a negative impact on gait, transfers, nursing and physiotherapy cares, chair or bed positioning, and daily activities.

It can have multiple causes, articular or extra-articular. Hip x-rays can reveal structural abnormalities and help follow the morphometric evolution of the joint. The correlation between radiological aspect and clinical pain hasn't been proven in adults with cerebral palsy³, however Ramstad and Terjesen have found that hip pain is more frequent in severe hip displacement in children with cerebral palsy⁴

Intra-articular injections of local anesthetics are used for diagnostic purposes, to locate the pain and help pinpoint the cause. Intra-articular corticosteroid injections are used to treat coxarthrosis' symptoms⁴.

Botulinum toxin injections can also be used to treat spastic peri-articular hip muscles⁵ in order to reduce peri-articular muscles' imbalance and mechanical stress on the joint.

There aren't any consensual guidelines for the diagnosis and treatment of hip pain in adults with cerebral palsy. Our goal in this study was to investigate the efficiency of intra-articular injections of local anesthetics and corticosteroids, sometimes combined with botulinum toxin injections in peri-articular muscles, to diagnose and treat hip pain in adults with cerebral palsy.

III. MATERIALS AND METHODS

Between 2010 and 2020, 14 adults with cerebral palsy and with hip pain have been diagnosed and treated in our department. After a clinical examination and a hip x-ray, 13 of them received an x-ray guided intra-articular injection of local anesthetics in order to help identify the etiology. Twelve of them received intra-articular injections of corticosteroids when an intra-articular origin of the pain seemed probable. To reduce spastic muscle forces acting on the femoral head, some patients received injections of botulinum toxin in peri-articular muscles of the hip.

These procedures were performed under local or general anesthesia whenever the patient presented abnormal involuntary movements or agitation. Following the different procedures, all patients were allowed to carry out their usual daily activities without restrictions.

The average age of the patients at the time of the procedures was 27,4 years old.

This being a retrospective observational study of routine care follow-up, no approval for the ethics committee was required.

A. Patient characteristics (Table 1)

For each patients, the following data was collected through patient interview and medical record analysis :

- *demographic data* : age, gender ;
- *diagnosis and medical history* : history of lower-limbs surgery or spine surgery ;
- *functional abilities* : oral and gestural communication capacities, presence or absence of cognitive impairments, GMFCS level⁶, (*Annex 1*)
- *Hip pain characteristics* : date of first occurrence, type (mechanical, neuropathic, inflammatory, mixed), lateralization and precise location, triggers (constant, intermittent, occurring when walking, dressing, during transfers or hygiene care, when seated or asleep), frequency.

Table 1.

Patient characteristics.

| Patient no. | Age (years) | Sex | GMFCS (level) | Cognitive Impairment (^a) | Evaluation of pain | Baclofen Pump | Surgical History |
|-------------|-------------|-----|---------------|---------------------------------------|--------------------|---------------|---|
| 1 | 25 | M | V | Yes | hetero-assessment | No | Spinal fusion |
| 2 | 20 | M | IV | No | self-assessment | No | Varization osteotomy ; tenotomy of the adductors |
| 3 | 23 | M | V | Yes | hetero-assessment | Yes | Spinal fusion ; tenotomy of the adductors |
| 4 | 24 | M | V | Yes | hetero-assessment | Yes | Spinal fusion ; tenotomy of the adductors and iliopsoas ; femoral head and neck resection |
| 5 | 38 | F | IV | No | self-assessment | No | Varization osteotomy |
| 6 | 24 | F | III | No | self-assessment | No | tenotomy of the adductors, iliopsoas and hamstrings; derotational osteotomy; periacetabular osteotomy |
| 7 | 20 | M | V | Yes | hetero-assessment | No | None |
| 8 | 23 | M | III | No | self-assessment | No | Tenotomy of the adductors and hamstrings |
| 9 | 38 | F | IV | No | self-assessment | No | Chiari osteotomy ; tenotomy of the adductors |
| 10 | 26 | M | V | Yes | hetero-assessment | No | None |
| 11 | 26 | M | IV | No | self-assessment | No | Tenotomy of the adductors, hamstrings, iliopsoas and spinal erectors |
| 12 | 31 | F | V | Yes | hetero-assessment | No | Femoral head and neck resection ; tenotomy of the adductors and hamstrings |
| 13 | 28 | F | IV | No | self-assessment | No | Spinal fusion ; tenotomy of the adductors |
| 14 | 38 | M | IV | Yes | Hetero-assessment | No | Spinal fusion |

(^a) All patients without cognitive impairment were able to communicate either orally or gesturally

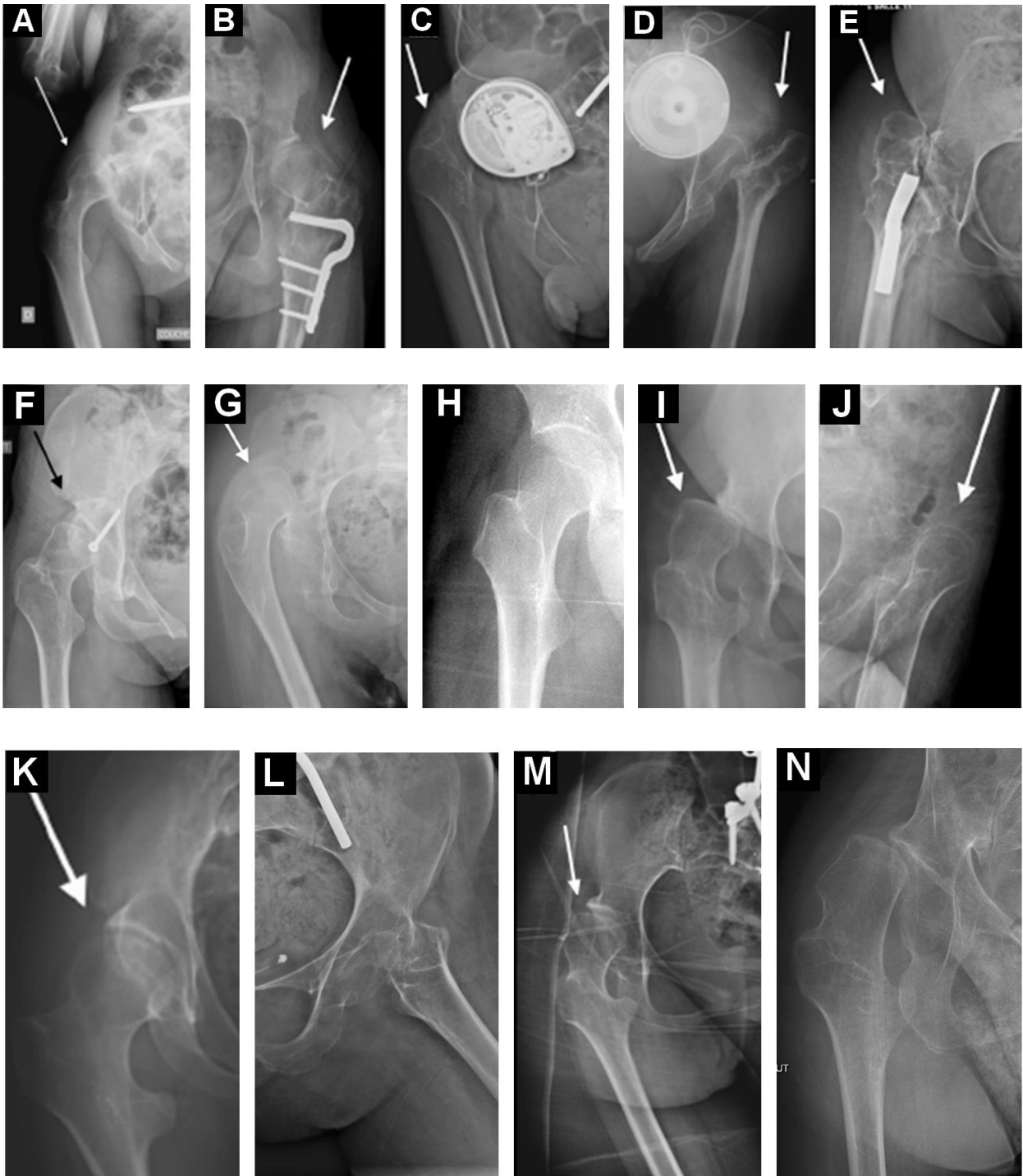


Figure 1. Radiological aspects.

A, (case #1) Dislocation, impingement. **B,** (case #2) Subluxation. **C,** (case #3) Dislocation. **D,** (case #4) Femoral head and neck resection, impingement. **E,** (case #5) Dislocation, neo-hip joint. **F,** (case #6) Hip dysplasia. **G,** (case #7) Dislocation. **H,** (case #8) Normal. **I,** (case #9) Subluxation. **J,** (case #10) Dislocation. **K,** (case #11) Hip dysplasia. **L,** (case #12) Subluxation. **M,** (case #13) Subluxation. **N,** (case #14) Dislocation, dysplasia.

B. Pelvic x-rays (Figure 1)

Pelvic x-rays were analysed to help determine the cause of pain. The extent of the femoral head's displacement was measured by using Reimers' migration percentage (MP)⁷. The following abnormalities were searched: hip dysplasia (MP<30%), hip subluxation (30%<MP<100%), hip dislocation (MP>100%), degenerative osteoarthritis, paraosteoarthropathy, fracture, signs of previous surgery.

C. Primary pain characteristics

All patients suffered from unilateral hip pain and all hip pains were mechanical. The pain was occurring on a daily basis for 12 of the 14 patients.

D. Intra-articular anesthetic test

This test was used to help determine the cause of pain on 13 of the patients. Under either x-ray or scan control, 1 to 3 cc of local anesthetic, either lidocaine (Xylocaïne®) or ropivacaine (Naropéine®), were injected in the femoroacetabular joint by experienced interventional radiologists. Hip pain level was evaluated 1 hour after the procedure. We considered that pain relief under 1 hour was in favour of an intra-articular origin. If the pain had not abated then a peri-articular or extra-articular (such as spinal, neuropathic or visceral) origin was evoked.

E. Intra-articular corticosteroid injection

When an intra-articular origin of the pain was suspected, an intra-articular injection of corticosteroid was added to the procedure. The products used were: cortivazol 3,75mg/1,5ml (Altim®), triamcinolone acetonide (Kénacort® 40), and betamethasone (Diprostène®).

F. Intra-muscular botulinum toxin injections

Patients with spastic peri-articular hip muscles received electrostimulation-guided botulinum toxin injections, using either Botox® or Dysport®. The aim was to lower the muscle imbalance and to reduce hip pain. The dilutions were 100 U of Botox® per mL of 0.09% sodium chloride and 500 U of Dysport® per mL of 0.09% sodium chloride.

To assess spasticity, the modified Ashworth scale was used, grading muscle tone from 0 to 4 (Annex 3). These botulinum toxin injections were conducted on the same day than the intra-articular ones, or within 48 hours at most. For only one of the 14 patients, the botulinum toxin injections were performed on their own, without being associated to any intra-articular injection.

G. **Pain assessment**

Our primary endpoint was the pain evaluation 1 hour after the intra-articular anesthetic test. Secondary endpoints were the pain evaluation 3 months after the intra-articular corticosteroid injection and beyond 3 months.

Face Pain Scale (FPS), Numeric Pain Rating Scale (NPRS), or Visual Analog Scale (VAS) were used when possible. In the case of patients with cognitive impairment, a hetero-evaluation was used, by interviewing the patient's close caregivers and/or by using the Doloplus Behavioral Scale⁸.

This being a retrospective observational study, no statistical analysis was used.

IV. **RESULTS**

A. **Diagnostic test: intra-articular anesthetic injection (table 2)**

An x-ray or scan-guided intra-articular anesthetic injection was conducted on 13 of the 14 patients. **The anesthetic test was efficient for 11 of the 13 patients with a complete disappearance of the pain within 1 hour.** Regarding the 2 patients (cases 8 and 13) with a negative test, the cause of pain was most likely peri-articular.

In a context of pain recurrence, 3 of the 13 patients received more than one intra-articular anesthetic injection (between 2 and 4), with at least 3 months between each injections and in association with corticosteroids.

B. **Intra-articular corticosteroid injection (table 2)**

For 12 of the 13 patients who were injected with anesthetics, an intra-articular corticosteroid injection was carried out during the same procedure.

Again, in a context of pain recurrence, 3 of the 12 patients received more than one intra-articular corticosteroid injection (between 2 and 3), with at least 3 months between each injections.

C. **Intra-muscular botulinum toxin injections (table 2)**

Seven of the 12 patients who were injected with intra-articular corticosteroids received botulinum toxin injections in peri-articular hip muscles.

Patient 8's anesthetic test wasn't efficient and he didn't receive corticosteroid injections. However he was injected with botulinum toxin.

Patient 11 only received botulinum toxin injections, without any intra-articular injection associated.

D. **Efficiency of the intra-articular corticosteroid injections ± associated with intra-muscular botulinum toxin injections (table 2)**

Three months after the first injections, hip pain had disappeared for 10 of the 12 patients who were injected with corticosteroids. Six of these 10 patients had received botulinum toxin injections as well, four of them had only been injected with corticosteroids.

The average length of efficiency at the time of our evaluation was 4,3 months, with extremes going from 2 to 12 months and a median of 3 months.

Concerning patient 8 and 11, who were injected with botulinum toxin but didn't receive corticosteroid injections, hip pain was absent 3 months after the injections. In their cases, the botulinum toxin injections had been both a diagnostic and therapeutic test.

E. **Side effects**

There were no side effects to be noted after the intra-articular injections: no septic arthritis, no hematoma. Likewise, no side effects were reported after the intra-muscular botulinum toxin injections: no hematoma, no flu-like symptoms, no dysphagia.

Table 2.

Diagnostic anesthetic test, intra-articular corticosteroid injections, intra-muscular botulinum toxin injections: effectiveness.

| Patient no. | Anesthetic test (n = number of tests) | Effectiveness of the anesthetic test, 1 hour post-injection | Intra-articular corticosteroid injections (n= number of injections) | Botulinum toxin injections | Pain relief 3-months post-treatment |
|-------------|---|---|---|--|---|
| 1 | Lidocaine | Yes | Cortivazol | Botox® 250 UI | Yes. Pain returned after 4 months. |
| 2 | Ropivacaine | Yes | Betamethasone | No | No |
| 3 | Lidocaine | Yes | Cortivazol | No (Baclofen Pump) | Yes (Doloplus 3/30) |
| 4 | Lidocaine | Yes | Cortivazol | Dysport® 800 UI | Yes, still effective at 7 months (Doloplus 4/30) |
| 5 | n=2 1. Lidocaine 2. Lidocaine | 1. No 2. Yes FPS 10→2 | n=2 1. Cortivazol 2. Cortivazol | 1. Botox® 300 UI 2. No | 1. Yes for a year 2. Pain returned after 2 months |
| 6 | Lidocaine | Yes, FPS 6→0 | Cortivazol | No | Yes, FPS 0/10 |
| 7 | n=3 1. Ropivacaine 2. Ropivacaine 3. Lidocaine | 1. Yes 2. Yes 3. Yes | n=3 1. Triamcinolone 2. Cortivazol 3. Betamethasone | 1. Botox® 300 UI 2. Botox® 300 UI 3. Botox® 300 UI | Pain returned after 3, 2, and 3 months |
| 8 | Lidocaine | No FPS 4→4 | n=0 | Botox® injection at a later stage | Yes, still effective at 6 months (FPS 0/10) |
| 9 | Lidocaine | Yes | Cortivazol | Botox® 300 UI | Pain returned after 2,5 months |
| 10 | Lidocaine | Yes | Cortivazol | No | Yes, Doloplus 3/30 |
| 11 | n=0 | - | n=0 | Botox® 400 UI | Yes, NRS 0/10 |
| 12 | Lidocaine | Yes | Cortivazol | No | Yes, Doloplus 8/30 |
| 13 | Lidocaine | No | Betamethasone | Dysport® 800 UI | Yes, pain returned after 4 months |
| 14 | n=2 1. Lidocaine 2. Lidocaine | 1. Yes 2. Yes | 1. Betamethasone 2. Betamethasone | Botox® 150 UI | 1. Yes, for 4 months 2. Pain returned after 3 months |

FPS = Faces Pain Scale

F. Assessment beyond 3 months and follow-up

Three patients were eventually treated by surgery after the various injections.

- Patient 1: an open wedge valgus osteotomy was performed 4 months after the intra-articular injections. The surgery was complicated by septic arthritis and a proximal femoral resection was carried out 3 months after the first intervention, associated with a tenotomy of the adductors. Two years after that last procedure his pain had been relieved.

- Patient 2: several soft tissue surgical procedures (tenotomies) were performed 6 months after the intra-articular corticosteroid injection which hadn't been efficient. It was then followed by a proximal femoral resection and iterative botulinum toxin injections.

- Patient 7: tenotomies of peri-articular hip muscles (sartorius, adductor longus, semitendinosus, rectus femoris) were performed, three months after the third intra-articular injection of local anesthetics and corticosteroids. A fourth injection of the same products was associated to the tenotomies, to lower the risk of post-surgery pain.

As of today seven patients (patients 2, 4, 7, 8, 11, 13 and 14) are still being regularly injected with botulinum toxin. Their hip pains have abated.

The other seven patients are under a simple clinical follow-up and all of them have been relieved from their hip pain.

G. Diagnostic and therapeutic algorithm (Figure 2)

The review and synthesis of this series of cases allowed us to develop a decision algorithm which aims to provide guidance for diagnosis and treatment of hip pain in adults with cerebral palsy.

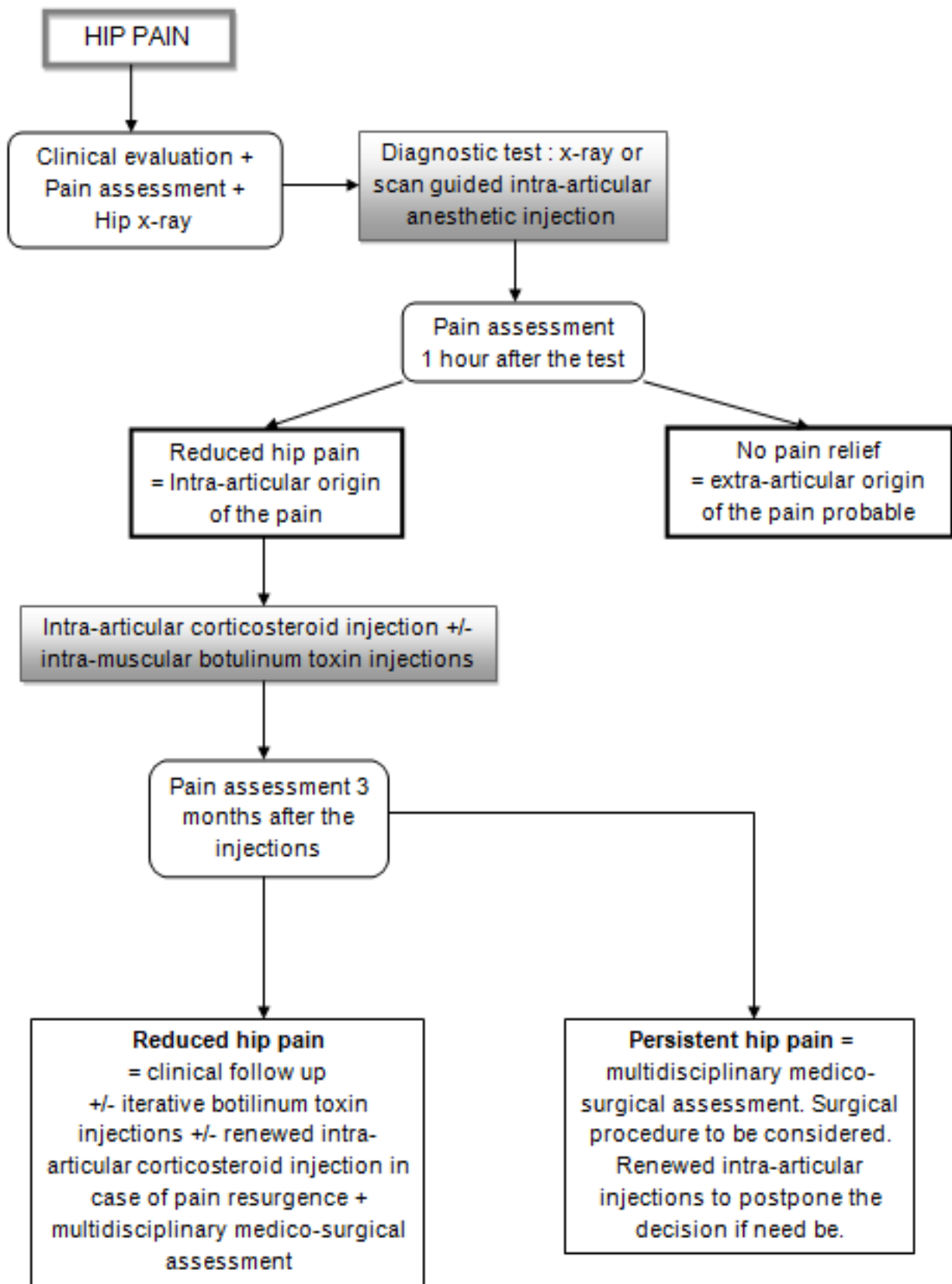


Figure 2. Diagnostic and therapeutic algorithm for treatment of hip pain in adult patients with cerebral palsy.

V. **DISCUSSION**

A. **Sampled population**

The participants in our study are a representative sample of the target population, namely adult patients with cerebral palsy being at risk of developing hip pain. On a functional perspective, they are ranked level III, IV and V on the GMFCS scale. These GMFCS levels are at higher risk of developing hip pain than the lower levels I and II⁹. Moreover, the majority of patients in our sampled population suffer from tetraparesis which has been shown to be a greater source of hip pain than the other type of cerebral palsy⁹.

It is this particular population of severely impaired patients which requires a specifically adapted care. Due to communication alteration, cognitive impairment, and sensory deficits, both diagnosis and efficiency evaluation of pain treatment can be challenging.

There has been numerous studies investigating the incidence of hip pain in adults with cerebral palsy. However these studies often have limited inclusion criteria. Jahnsen and al.¹⁰ noted an incidence of 36% hip pain in the 322 total analysed cases. Yet patients with cognitive impairment were excluded from their study. In addition there were only 24 patients with tetraparesis amongst the participants. Similarly, in Engel and Al.² study, hip pain incidence of 63,1% in adults with cerebral palsy was measured in a population of patients with an intelligence quotient over 70 and able to self-evaluated their amount of pain on a scale from 0 to 10.

This tendency to exclude patients suffering from cognitive impairment can be found in many studies. It can help with pain assessment, since patients can self-evaluate, but it also omits a significant proportion of patients with cerebral palsy.

B. **Clinical pain assessment**

Our study highlighted the difficulty of assessing pain in patients with cerebral palsy by means of a unique and uniform scale, especially in the case of severely affected patients.

Four different types of pain scales were used in our study, due to the heterogeneity of communicating abilities of our patients: Faces Pain Scale, Numeric pain Rating Scale, Visual Analog Scale, and Doloplus Scale. Communication and cognitive impairments,

visual deficit, ability to designate, ability to perceive pain were the factors which guided the choice of pain scale.

The Pain Assessment Instrument for Cerebral Palsy¹¹ (Annex 2), was developed as a specific self-evaluation to estimate hip pain in adults with cerebral palsy. It helps diagnose overlooked pain and was designed to be used on patients with communication impairment. It consists of the usual Faces Pain Scale plus additional images representing daily activities that can trigger pain. It would be an interesting tool to use in a larger prospective study with patients who are able to self-evaluate through designation.

In Hodgkinson and Al's study¹², the San Salvador scale is used to hetero-evaluate, but it takes longer to use than the Doloplus scale's.

Hip pain assessment could also be estimated through a quality life questionnaire. The Brief Pain Inventory could be used to assess the impact of hip pain on the general activity, mood, walking capacity, usual work, relationships and sleep¹³.

Through experience we can assume that the Face Pain Scale is the most appropriate tool to use with patients without major cognitive impairment, who are able to express themselves through visual or gestural communication. With non-communicating patients suffering from cognitive impairment, the Doloplus scale is quick and easy to use.

C. **Benefit of intra-articular anesthetic injections**

Intra-articular anesthetic injections seem to be a useful diagnostic tool to help confirm the intra-articular origin of hip pain in adults with cerebral palsy. If the hip pain is relieved by the test, it is a strong argument for an intra-articular origin of the pain.

The quantity of anesthetics injected in our study was variable, from 1 to 3 mL of lidocain. The literature review shows that the total volume of anesthetics and corticosteroids injected in the hip joint ranges from 3 to 12 mL. Young and Al. have compared two randomized groups of patients who were injected with 40 mg of triamcinolone and 2 mL of bupivacain with different total volumes. In group B, 6 mL of sterile water was added. The final injected volume was of 3 mL in group A and 9 mL in group B. The authors didn't note more side effects in group B. They didn't observe any significant difference of efficiency, in particular on pain reduction or function

improvement. They recommend to inject between 3 and 9 mL of liquid for intra-articular hip injection¹⁴.

Ashok and Al. used intra-articular anesthetic tests previous to hip joint replacements to ensure that the hip pain had indeed an intra-articular cause, in part to differentiate it from lumbar referred pain when the origin of the pain wasn't certain. On 77% of the 48 patients of their study who were suffering from hip pain, an intra-articular anesthetic test was carried out and turned out to be effective. Amongst the 34 patients who undergone surgery, 33 of them were relieved from their hip pain. The specificity of the anesthetic test was 91% and its sensitivity 97%¹⁵.

Very few side effects consecutive to the intra-articular anesthetic injections are reported in literature. Braunstein reports an overall good tolerance with the following possible side effects: numbness lasting up to 2 hours after the procedure (anesthetics in contact with the femoral nerve), non-surgical hematoma¹⁶, local chondrocyte toxicity due to bupivacaine¹⁷.

D. Hip pain management through intra-articular corticosteroid injections

Multiple types of corticosteroids were used in our study. In spite of their diverse duration of action, there isn't one molecule which is prioritized above others for intra-articular hip injections, in particular to treat osteoarthritis.

Intra-articular corticosteroid injections have a therapeutic goal and not a diagnostic one. If hip pain isn't relieved by local corticosteroids, an intra-articular origin of the pain can't be excluded. Intra-articular corticosteroid injections are an effective treatment of osteoarthritis⁴. They are used as a second-line treatment, when hip pain resists treatment by oral analgesic products, including non-steroidal anti-inflammatory drugs¹⁸.

It can be used previous to hip surgery, with a minimum waiting period of 2 months between the intra-articular corticosteroid injection and hip replacement. Without this two-months delay the post-surgical infection risk is estimated at 10%¹⁹. In our series, one patient (case 1) suffered from a post-surgical septic arthritis after an open wedge valgus osteotomy. The intra-articular corticosteroid injection was performed more than 4 months before the surgery.

The presence of osteosynthesis material in the joint wasn't a contraindication to the intra-articular corticosteroid injection since it is not in contact with the joint capsule.

Intra-articular corticosteroid injections can be repeated with a waiting period of 3 months between each injection, in case of hip pain reappearance. Three of our patients were injected 2 to 3 times because of pain recurrence and the need to temporize while waiting for multidisciplinary deliberation and a potential surgery.

The decision to inject both anesthetics and corticosteroids at the same time without waiting for the result of the anesthetic test was based on the benefit/risk balance. There would have been a greater risk of sepsis with two intra-articular injections instead of one. The potential benefit of the intra-articular corticosteroid injection was superior to this risk especially with our most fragile patients. This is why when the intra-articular origin of the pain was strongly suspected, corticosteroid injections were performed at the same time than the anesthetic injections. This wasn't the case with patient 8, who was a GMFCS III 23 year-old patient. The decision to inject both products in one sitting or to wait for the result of the anesthetic test before injecting corticosteroids should be made individually for each patient.

E. Benefit of intra-muscular botulinum toxin injections

The main goal of botulinum toxin injections was to relieve pain caused by spasticity, by reducing the imbalance between agonist and antagonist muscles. They can also be used as a diagnostic test by assessing their effect on hip pain after 6 to 12 weeks.

The intra-articular anesthetic test wasn't carried out in one of our patients (case 11). He only had botulinum toxin injections in the following muscles: gluteus minimus, anterior fascicle of the medium gluteus, adductors, hamstrings. The patient was relieved of hip pain after these injections. Patient 11 had no cognitive impairment and was able to communicate, which was of great help to insure that the pain had been relieved by the injections and was indeed due to peri-articular hip muscles' spasticity.

Very few papers in literature mention the possible use of botulinum toxin to treat hip pain in adults with cerebral palsy. Contrary to children with cerebral palsy, whose positive reaction to botulinum toxin used as a treatment for hip pain has been proven. Lundy and Al. have shown the efficiency of botulinum toxin to decrease hip pain in children with cerebral palsy, by assessing pain 3 months after the injections in peri-

articular muscles on 26 children with GMFCS V tetraparesis, with an average age of 11,5 years²⁰.

It is important to note that spastic cocontraction can sometimes help patient verticalization and gait by compensating for impaired voluntary command of certain muscle groups. However, Maanum and Al. have conducted a randomized, double-blind, placebo-controlled trial focusing on the effect of botulinum toxin injections on ambulant adults with cerebral palsy (GMFCS II). No major side effect was reported. Eight weeks after the injections, the self-assessed spasticity level on a visual analogue scale (from 0 to 10), as well as the self-evaluation of the global perceived effect (verbal assessment : worst/same/better), had significantly improved in the botulinum toxin A group.

Botulinum toxin injections can be used to diminish spasticity before a hip surgery, to lower mechanical stress on the joint, and to lower post-surgical pain²¹. They can also help delay peri-articular hip tenotomies²².

F. Limitations of our study

The small number of participants is one of the main limitations of our study.

On a methodological level, it wouldn't have been ethical to include a control group with an intra-articular injection of a placebo.

Considering the diversity of pain assessment tools we used, the fact that the study was retrospective, and the absence of standardized evaluation methodology, we weren't able to compare the data preceding and following the injections.

G. Diagnostic and therapeutic algorithm

To our knowledge, no prior studies have examined the possible benefit of intra-articular anesthetic injections to help diagnose hip pain causes in adults with cerebral palsy. The same goes for intra-articular corticosteroid injections and peri-articular hip muscle injections as hip pain treatment.

Murphy and al mention, in a general overview article, the possible use of scan guided intra-articular anesthetic and corticosteroid injections to treat hip pain due to femoroacetabular incongruity or osteoarthritis in adults with cerebral palsy. He describes a positive effect lasting at least 6 months, but no clinical study's results was reported.²³

In our case series, we observed a benefic effect lasting at least 3 months following the intra-articular corticosteroid injections sometimes associated with peri-articular hip muscle injections. This result will have to be confirmed by a prospective study with a greater number of participants. Hirsh and Al. have investigated, through a retrospective questionnaire, which treatments were used on adults with cerebral palsy suffering from hip pain. The only interventional procedures were motor nerve blocks²⁴.

The fact that we often used two treatments concomitantly, corticosteroids and botulinium toxin, makes it difficult to identify exactly which was efficient and it is possible that the best outcomes came from the association of the two, since the origin of pain is often multifactorial. However a negative anesthetic test is in favor of an extra-articular origin of the pain and so in favor of the efficiency of botulinum toxin when the pain was relieved at 3 months.

These various local treatments enabled us to reduce the use of oral and intrathecal drugs. In the case of patient 2 a complete withdrawal from intrathecal baclofene was possible after his hip pain was treated.

These local interventional treatments may sometimes be the only available tool at our disposal when patients present contraindications for surgical treatment.

We established a diagnostic and therapeutic algorithm (*figure 2*) which will need confirmation from a prospective study with a greater number of participants.

VI. CONCLUSION

In spite of the high incidence of hip pain in adults with cerebral palsy, there is no guidelines to diagnose and treat it.

Patients with cerebral palsy are a very heterogeneous population. Pain assessment is often difficult in this population due to communication disorders and/or cognitive impairment.

Hip pain can have many different origins, whether it be intra-articular or extra-articular. An intra-articular anesthetic injection can, in the case of a positive outcome, weigh in favor of an intra-articular origin of the pain.

In terms of therapeutic treatments, intra-articular corticosteroid injections can be performed, eventually with the addition of botulinum toxin injections in order to reduce the imbalance between agonist and antagonist muscles caused by spasticity. A positive therapeutic effect can be seen up to at least 3 months after the injections and sometimes enable a permanent relief or temporary relief while waiting for surgery.

As far as we know, no previous research has investigated this type of diagnostic and therapeutic approach in the specific case of adults with cerebral palsy. For some patients, surgery is eventually required after multidisciplinary deliberation between medical and surgical teams. The various medical explorations and treatments performed prior to the deliberation can help to choose the most appropriate type of intervention: tenotomies, osteotomy, arthroplasty, proximal femoral resection.

At a more practical level, it would be interesting to specify the volume of anesthetics to inject and the type of corticosteroid to use, in light of their specific duration of action and contraindications. A prospective study following a cohort of adult patients with cerebral palsy, with an adequate number of participants, should help support these diagnostic and therapeutic procedures.

VII. COMMENTAIRE (Français)

En dépit de la fréquence élevée des coxalgies chez les patients adultes paralysés cérébraux, il n'existe pas de recommandations concernant leur prise en charge diagnostique et médicale.

L'évaluation de la douleur en elle-même peut s'avérer difficile chez ces patients souvent non communicants et le diagnostic étiologique peut être tout aussi délicat étant donné les multiples causes possibles, articulaires ou extra-articulaires.

La réalisation d'un test anesthésique, par injection dans l'articulation coxo-fémorale de lidocaïne ou ropivacaïne sous contrôle scopique, peut orienter le diagnostic vers une origine intra-articulaire s'il permet de soulager la douleur dans l'heure qui suit. Dans ce cas, une infiltration de corticoïdes peut être effectuée pour tenter de soulager la douleur, au même titre que chez les patients atteints de coxarthrose. Lorsque qu'une origine intra-articulaire de la douleur est fortement suspectée, les deux gestes peuvent être réalisés dans le même temps afin de limiter les injections intra-articulaires et ainsi de diminuer le risque d'effets indésirables.

Dans notre série de cas, un test anesthésique a été réalisé chez 13 patients et la douleur était soulagée à 1 heure chez 11 de ses patients. Ces 11 patients, ainsi que la patiente 12, chez qui le test anesthésique était négatif mais où une origine intra-articulaire de la douleur était tout de même suspectée, ont bénéficié d'une infiltration intra-articulaire de corticoïdes. Trois mois après ces infiltrations, les coxalgies étaient fortement améliorées chez 10 de ces 12 patients ayant reçu les corticoïdes intra-articulaires.

Sept des 10 patients qui ont été soulagés présentaient une spasticité péri-articulaire importante et ont également bénéficié d'injections de toxine botulique dans les muscles pouvant être responsables d'un déséquilibre mécanique au niveau de l'articulation.

Le patient 8 n'a pas ressenti d'amélioration à la suite du test anesthésique. Il n'a donc pas reçu d'infiltration de corticoïde mais a été traité par injections de toxine botulique. La coxalgie a fortement diminué à la suite des ces injections de toxine, confirmant l'origine extra-articulaire de la douleur chez ce patient. C'était également le cas pour le patient 11, chez qui le test anesthésique n'a pas été réalisé car une origine extra-

articulaire était d'emblée suspectée, et qui a lui aussi été soulagé par les injections de toxine botulique.

A la suite cette étude de cas, nous avons donc observé que ces procédures ont un effet thérapeutique sur au moins 3 mois et peut permettre de soulager définitivement ou transitoirement la douleur en attendant une prise en charge chirurgicale.

Ce type de prise en charge diagnostique et thérapeutique médicale n'est pas décrit dans la littérature pour les adultes paralysés cérébraux.

Pour certains patients une prise en charge chirurgicale est à terme inévitable après une consultation pluridisciplinaire médico-chirurgicale. Les différents traitements médicaux réalisés au préalable peuvent aider au choix du type d'intervention chirurgicale : ténotomies, ostéotomies, arthroplastie, résection fémorale proximale.

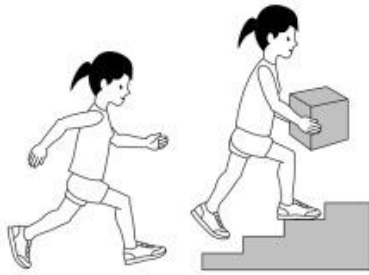
Nous avons établi un algorithme diagnostique et thérapeutique (*Figure 2*), mais une des limitations principales de notre étude étant le faible nombre de patients inclus, il devra être confirmé dans le futur par le suivi prospectif d'une importante cohorte de patients.

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IX. ANNEXES



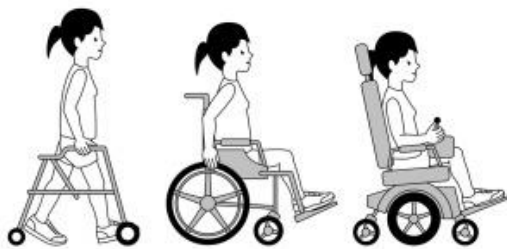
GMFCS Level I

Youth walk at home, school, outdoors and in the community. Youth are able to climb curbs and stairs without physical assistance or a railing. They perform gross motor skills such as running and jumping but speed, balance and coordination are limited.



GMFCS Level II

Youth walk in most settings but environmental factors and personal choice influence mobility choices. At school or work they may require a hand held mobility device for safety and climb stairs holding onto a railing. Outdoors and in the community youth may use wheeled mobility when traveling long distances.



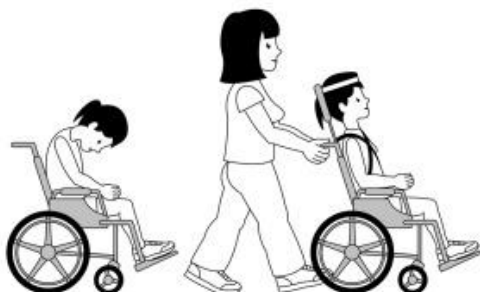
GMFCS Level III

Youth are capable of walking using a hand-held mobility device. Youth may climb stairs holding onto a railing with supervision or assistance. At school they may self-propel a manual wheelchair or use powered mobility. Outdoors and in the community youth are transported in a wheelchair or use powered mobility.



GMFCS Level IV

Youth use wheeled mobility in most settings. Physical assistance of 1-2 people is required for transfers. Indoors, youth may walk short distances with physical assistance, use wheeled mobility or a body support walker when positioned. They may operate a powered chair, otherwise are transported in a manual wheelchair.

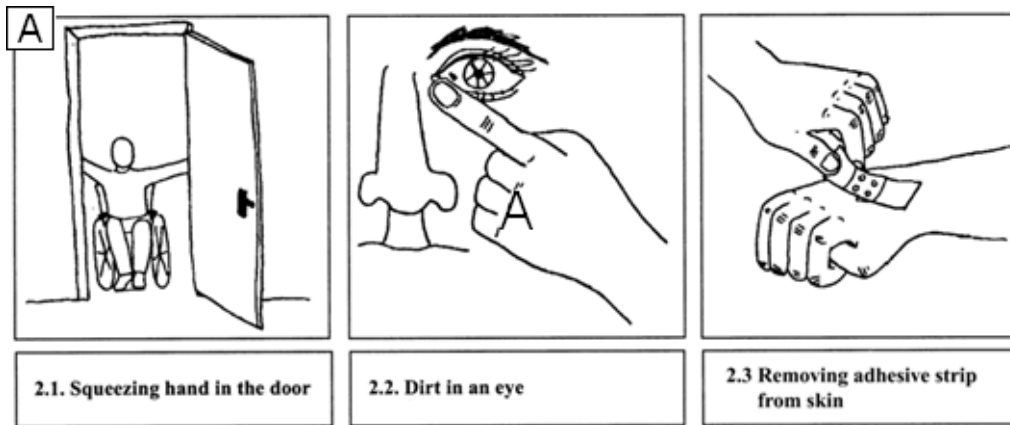


GMFCS Level V

Youth are transported in a manual wheelchair in all settings. Youth are limited in their ability to maintain antigravity head and trunk postures and control leg and arm movements. Self-mobility is severely limited, even with the use of assistive technology.

GMFCS descriptors: Palisano et al. (1997) Dev Med Child Neurol 39:214-23
CanChild: www.canchild.ca

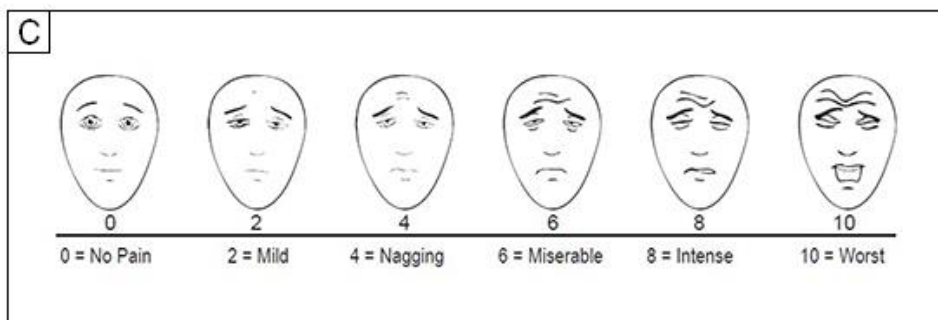
Illustrations copyright © Kerr Graham, Bill Reid and Adrienne Harvey,
The Royal Children's Hospital, Melbourne



B

| Item | Painful | Not Painful | Possibly Painful |
|--|---------|-------------|------------------|
| 1. Squeezing a hand in the door | X | | |
| 2. Dirt in an eye | X | | |
| 3. Removing adhesive strip from the skin | X | | |
| 4. Injection by a dentist | X | | |
| 5. Putting on trousers | | | X |
| 6. Drinking hot tea | X | | |
| 7. Cleaning teeth | | X | |
| 8. Eating bread | | X | |
| 9. Burning hand | | X | |
| 10. Doctor using a stethoscope | | X | |
| 11. Combing hair | | X | |
| 12. Biting own tongue | | X | |
| 13. Being lifted from bed | | | X |
| 14. Putting on sweater | | X | |
| 15. Listening to music | | X | |
| 16. Lying in bed | | | X |
| 17. Physiotherapy for legs | | | X |
| 18. Stubbing a toe | X | | |
| 19. Having a blood sample taken | X | | |
| 20. Sitting in a wheelchair | | | X |
| 21. Wasp sting | X | | |

Legend: Painful, situations usually painful in daily life; Not painful, situations usually not painful.



Annex 2. Pain Assessment Instrument for Cerebral Palsy (PAICP)

A. Examples of the images shown to the patient, representing daily situations that may or may not be painful.

B. PAICP items.

C. Patients rate the pain associated with each activity using a Faces Pain Scale.

| Grade | Description |
|--------------|--|
| 0 | No increase in muscle tone |
| 1 | Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the ROM when the affected part(s) is moved in flexion or in extension |
| 1+ | Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM |
| 2 | More marked increase in muscle tone throughout most of the ROM, but affected part(s) easily moved |
| 3 | Considerable increase in muscle tone, passive movement is difficult |
| 4 | Affected part(s) rigid in flexion or extension |

Annex 3. Modified Ashworth Scale.

SERMENT

- *En présence des Maîtres de cette école, de mes chers condisciples et devant l'effigie d'Hippocrate, je promets et je jure, au nom de l'Être suprême, d'être fidèle aux lois de l'honneur et de la probité dans l'exercice de la médecine.*

- *Je donnerai mes soins gratuits à l'indigent et n'exigerai jamais un salaire au-dessus de mon travail.*

- *Admis (e) dans l'intérieur des maisons, mes yeux ne verront pas ce qui s'y passe, ma langue taira les secrets qui me seront confiés, et mon état ne servira pas à corrompre les mœurs, ni à favoriser le crime.*

- *Respectueux (se) et reconnaissant (e) envers mes Maîtres, je rendrai à leurs enfants l'instruction que j'ai reçue de leurs pères.*

- *Que les hommes m'accordent leur estime si je suis fidèle à mes promesses. Que je sois couvert (e) d'opprobre et méprisé (e) de mes confrères si j'y manque.*

➤ **DIAGNOSTIC ET PRISE EN CHARGE MEDICALE DES DOULEURS DE HANCHES DES ADULTES PARALYSES CEREBRAUX**

Résumé :

Introduction : Les coxalgies sont fréquentes chez les adultes paralysés cérébraux et impactent négativement leur qualité de vie et leurs capacités fonctionnelles. Le but de cette étude de cas rétrospective était d'examiner l'intérêt d'injections intra-articulaires d'anesthésiques et de corticoïdes, plus ou moins associées à des injections intramusculaires de toxine botulique, pour la prise en charge des douleurs de hanches dans cette population.

Méthode : 14 patients paralysés cérébraux adultes (moyenne d'âge 27,4 ans) ont été pris en charge pour des douleurs de hanche entre 2010 et 2020. Une injection intra-articulaire d'anesthésique a été réalisée chez 13 de ces patients avec évaluation de l'efficacité à 1 heure. 12 patients ont reçu une ou plusieurs infiltrations de corticoïde. 9 patients ont bénéficié d'injections intramusculaires de toxine botulique. Une évaluation de la douleur de hanche a été effectuée à 3 mois des gestes.

Résultats : Le test anesthésique a été efficace pour 11 des 13 patients injectés. 10 des 12 patients chez qui ont été réalisées les infiltrations de corticoïdes ont vu une diminution de leur coxalgie à 3 mois. Parmi ces 12 patients, 7 ont également bénéficié d'injections de toxine botulique. 2 patients, chez qui une origine extra-articulaire de la douleur était suspectée, ont reçu des injections de toxine botulique sans infiltration de corticoïde. Ils étaient tous deux soulagés de leur douleur de hanche à 3 mois.

Conclusions : Les tests anesthésiques ont permis d'orienter le diagnostic étiologique des coxalgies en confirmant une origine intra-articulaire à la douleur. En cas de test positif, les infiltrations de corticoïdes se sont avérées efficaces pour soulager la douleur pendant au moins 3 mois. Les injections de toxine botulique dans les muscles péri-articulaires ont permis de diminuer une partie des douleurs d'origine extra-articulaire. Au vu de ces résultats, nous proposons un arbre décisionnel pour orienter la prise en charge des coxalgies des adultes paralysés cérébraux, pour tenter de les soulager au mieux, parfois au long cours, parfois dans l'attente d'une chirurgie pour en pérenniser l'efficacité.

Mots-clés : paralysie cérébrale ; adultes ; douleur ; hanche ; injections intra-articulaires ; anesthésique ; corticoïdes ; toxine botulique.