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Original article

Post-stroke flexed elbow deformity management: consensus opinion from an international Delphi expert panel

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Abbreviations: BoNT, Botulinum Toxin Type A; FE, Flexed Elbow; PMR, Physical Medicine and Rehabilitation

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ABSTRACT

Background: Poststroke flexed elbow deformity is a frequent and disabling abnormal joint posture that impairs function, hygiene, and quality of life. Despite its clinical impact, assessment strategies and treatment sequencing remain heterogeneous, fragmented across disciplines, and poorly standardized.
Objectives: To establish an international, interdisciplinary expert consensus on the assessment and management of poststroke flexed elbow deformity using a hypothesis-driven Delphi methodology.
Methods: An international Delphi process was conducted involving 28 experts in physical and rehabilitation medicine, orthopedic surgery, and neurosurgery from 12 countries. Three sequential, anonymous rounds of structured online questionnaires were administered. Statements addressed diagnosis, clinical and instrumental assessment, treatment selection, and surgical indications. Experts rated their agreement with each statement. Consensus was predefined as ≥80% agreement among respondents for a given item.
Results: Across 3 Delphi rounds, 164 statements were evaluated, of which 61 (38%) reached consensus. Experts, including physical and rehabilitation medicine physicians ($n = 13$), orthopedic surgeons ($n = 10$), and neurosurgeons ($n = 1$) agreed that functional impact assessment must precede treatment decisions and that differentiation between muscle overactivity and soft-tissue contracture is essential. Diagnostic motor nerve blocks and radiological imaging were endorsed as complementary tools in selected cases. Botulinum toxin injections combined with rehabilitation were supported as first-line treatment for correctable deformities, whereas surgical intervention was considered appropriate for partially or non-correctable deformities. Preoperative interdisciplinary consultation and formal goal setting were deemed mandatory before intervention.
Conclusions: This Delphi-based international consensus provides structured, interdisciplinary guidance for the evaluation and management of poststroke flexed elbow deformity. By clarifying assessment principles, treatment sequencing, and indications for referral and surgery, this consensus aims to standardize care pathways and improve patient-centered outcomes.
Registration: Not applicable. This study used a Delphi methodology involving expert opinion only, without human participant intervention.

Introduction

Flexed elbow (FE) deformity is a common abnormal joint posture that occurs in individuals after acquired brain injury, such as stroke, traumatic brain injury, or cerebral anoxia [1,2]. FE deformity is a major factor that limits the capacity to dress, clean, and reach objects in the environment [3,4]. Dressing and cleaning the FE causes pain when trying to extend the FE deformity [4–6]. Individuals with severe FE deformity often develop fungal infection, skin maceration, and skin breakdown in the antecubital fossa, which exacerbates pain and contributes to further deformities [2,3]. Some individuals complain that their arm flexes toward their chest due to FE and find this position to be unesthetic. This phenomenon can occur when the person is resting or moving, as FE can be triggered by motions such as standing up and walking [1]. When volitional control remains in the upper limb after acquired brain damage, FE can limit the capacity to manipulate objects in the environment (reaching, swapping places, or bringing objects to the body) [6].

FE deformity is a result of both neurological and orthopedic complications, which may be attributed to muscle overactivity (spasticity, spastic dystonia, spastic co-contractions, synkinesis, and nociceptive spasms), soft-tissue contracture (muscle, tendon, ligaments, joint capsule), or neurogenic heterotopic ossification (ectopic bone formation developing mainly after central nervous system damage) [7,8].

During clinical examination, a joint deformity is considered correctible when it can be returned to the full elbow extension (0°) either actively or passively during slow joint mobilization from elbow flexion to extension. In contrast, deformity is considered not correctable when mobilization of the joint is impossible, and the elbow remains in flexion during passive joint mobilization. In cases where deformity is not fully correctable during active or passive extension, and a residual flexion of the elbow persists, we consider it to be partially correctable. In case of partially correctable and non-correctable deformities, diagnostic motor nerve blocks may be useful in determining whether the deformity results solely from soft-tissue contracture or whether muscle overactivity also contributes [9].

Health care providers treating hemiplegic or hemiparetic individuals across the spectrum of care (including Physical Medicine and Rehabilitation (PMR) neurologists, geriatricians, neuro-psychiatrists, general practitioners, physiotherapists, occupational therapists, rehabilitation nurses and orthotists) should be able to identify the individual's FE deformity, ascertain how the FE is interfering with their daily life activities, and then refer the individual to a neuro-orthopedic professional or similar team specialized in abnormal joint posture management if needed.

Clinical assessment, technical examinations, and sequence of treatments are not clearly established for FE deformity, and access to such treatment depends on whether collaboration exists among different medical and surgical specialties [10–12]. Each discipline habitually works within its own silos of expertise and may thus be naive to how other disciplines approach treatment. Furthermore, the individuals' concerns and functional goals are not always clearly identified by the caregiver before treatment.

An interdisciplinary collaborative approach that includes the individual and their caregiver for treatment may therefore optimize the individual's ability to attain their active or passive goals. Unfortunately, there is currently no consensus on how to evaluate and manage FE deformity in individuals suffering an acquired brain injury, and the literature for the management of FE deformity is heterogeneous, encompassing only some disciplines and representing local team experiences [13–16]. The field of Neuro-orthopedics, which manages individuals with abnormal joint posture after stroke, is complex and highly specialized, with only a few interdisciplinary medico-surgical teams around the world. We thus conducted an international, interdisciplinary survey using the structured Delphi method to converge a consensus among non-specialist caregivers to accurately assess, refer, and treat individuals with disabling FE deformity.

Methods

Design

This investigation utilized a consensus study based on a Delphi method [17–19].

Regulatory and ethical aspects

This study was conducted in accordance with the STROBE reporting guidelines [20].

Participants

Experts were selected by the steering committee. The panel comprised physicians and surgeons selected based on their established clinical and/or scientific expertise in managing FE deformity resulting from central nervous system damage. Selection criteria included active participation in interdisciplinary medico-surgical networks and clinical experience treating upper-limb deformities. Scientific expertise requirements included peer-reviewed publications or international congress presentations on upper-limb muscle overactivity in upper motor neuron syndrome, upper-limb abnormal joint deformity posture, or related topics. To minimize recruitment bias, no >2 experts from the same center or discipline were included.

A total of 28 experts from 12 countries received invitations, representing physical and rehabilitation medicine physicians (n = 18), orthopedic surgeons (n = 7), and neurosurgeons (n = 3). Invitations were sent by email, with standardized reminders issued before each round deadline.

Procedure

A steering committee of 4 internationally recognized experts in abnormal joint deformities following central nervous system damage oversaw all stages of the process.

The Delphi process consisted of 3 iterative rounds. Items were primarily formulated using a 4-point Likert scale to avoid neutral responses: "Yes, systematically", "Yes, very often", "Yes, but rarely", "No"; binary responses "Yes"- "No", and multiple-choice questions were used when scaling was inappropriate (Appendix A). A total of 164 questions was distributed across the 3 rounds: 110 in Round 1, 37 in Round 2, and 17 in Round 3 (Table 1).

Round 1 was designed to establish preliminary consensus and to identify shared themes regarding the assessment and management of FE deformity. It comprised 4 sections: (1) identification of the causes of FE; (2) clinical exam and assessment tools for FE deformity; (3) medico-surgical decision-making sequence; and (4) principal surgical procedures. Round 2 aimed to quantify the level of agreement among panel members on the themes generated in Round 1, using Likert-scale questionnaires structured according to the same 4 sections. Round 3 focused on achieving a final consensus on the resulting items.

After each round, responses were analyzed anonymously, and the steering committee revised the questionnaires by deleting, reformulating, or merging items based on group feedback. The revised questionnaires were subsequently validated by all members of the steering committee and by an independent methodology team before the next round.

An independent methodology team (CLINRDS startup) supervised the Delphi process and implemented anonymous data collection using a secure, General Data Protection Regulation (GDPR)-compliant web platform (LimeSurvey).

Table 1
Delphi process, participant engagement, and consensus yield.

Item	Value *n* (%)
Experts invited	28 (100%)
PMR	15
Orthopedic surgeons	10
Neurosurgeons	3
Round 1 respondents	24 (86%)
PMR	13
Orthopedic surgeons	10
Neurosurgeons	1
Round 2 respondents	22 (79%)
PMR	12
Orthopedic surgeons	9
Neurosurgeons	1
Round 3 respondents	23 (82%)
PMR	14
Orthopedic surgeons	7
Neurosurgeons	2
Total items evaluated	164
Consensus statements	61 (38%)

Data analysis

An a priori consensus threshold was defined as ≥80% agreement among a minimum of 20 respondents, defined as selecting "Yes,…" ("Yes, systematically," "Yes, very often," and "Yes, but rarely") or "No" on Likert-scale items, or as >80% of respondents selecting the same response for multiple-choice items and binary questions [21–23].

Statistical analyses were performed independently by the CLINRDS startup. Only aggregated data (descriptive statistics for quantitative variables and percentages for categorical variables) were provided to the steering committee, ensuring full anonymity throughout analysis and interpretation. All participants fulfilled authorship criteria and received no financial compensation.

Results

Participant engagement and response rates

The Delphi process demonstrated strong participant engagement across all 3 rounds, with high response rates maintained throughout the study (Fig. 1). Over the 3 rounds, a total of 164 items were evaluated, resulting in 61 consensus statements, representing 38% of all items assessed (Table 1).

Identifying the causes of FE deformity

No consensus was obtained when ranking the elbow flexor muscles responsible for FE deformity (Table 2). However, experts most frequently identified the *brachialis* as the principal muscle involved, followed by the *biceps brachii* in second place, and the *brachioradialis* in third.

In contrast, experts were unanimous in not identifying *pronator teres, flexor carpi radialis, flexor digitorum superficialis,* or *supinator* as major muscles involved in FE deformity.

Clinical examination of FE deformity

Expert consensus established that assessing volitional muscle contraction during functional tasks plays a central role in therapeutic decision-making. Functional assessment was considered more influential than isolated analytical testing of elbow flexors when selecting treatment strategies (Table 2).

There was a strong consensus emphasizing the critical importance of differentiating muscle overactivity from soft-tissue contracture before considering surgical intervention. Additionally, assessment of triceps brachii volitional control and muscle overactivity before surgery was considered essential to prevent postoperative overcorrection resulting in elbow extension (Table 2).

Diagnostic nerve block utilization

There was strong consensus that total and/or selective musculocutaneous motor nerve blocks using local anesthetics were useful for evaluating FE deformity. It was concluded that musculocutaneous motor nerve blocks help identify the specific muscle contributions to the deformity and predict therapeutic responses. In contrast, motor nerve blocks of the radial nerve to assess the brachioradialis muscle's contribution to disabling FE deformity did not achieve consensus (Table 2).

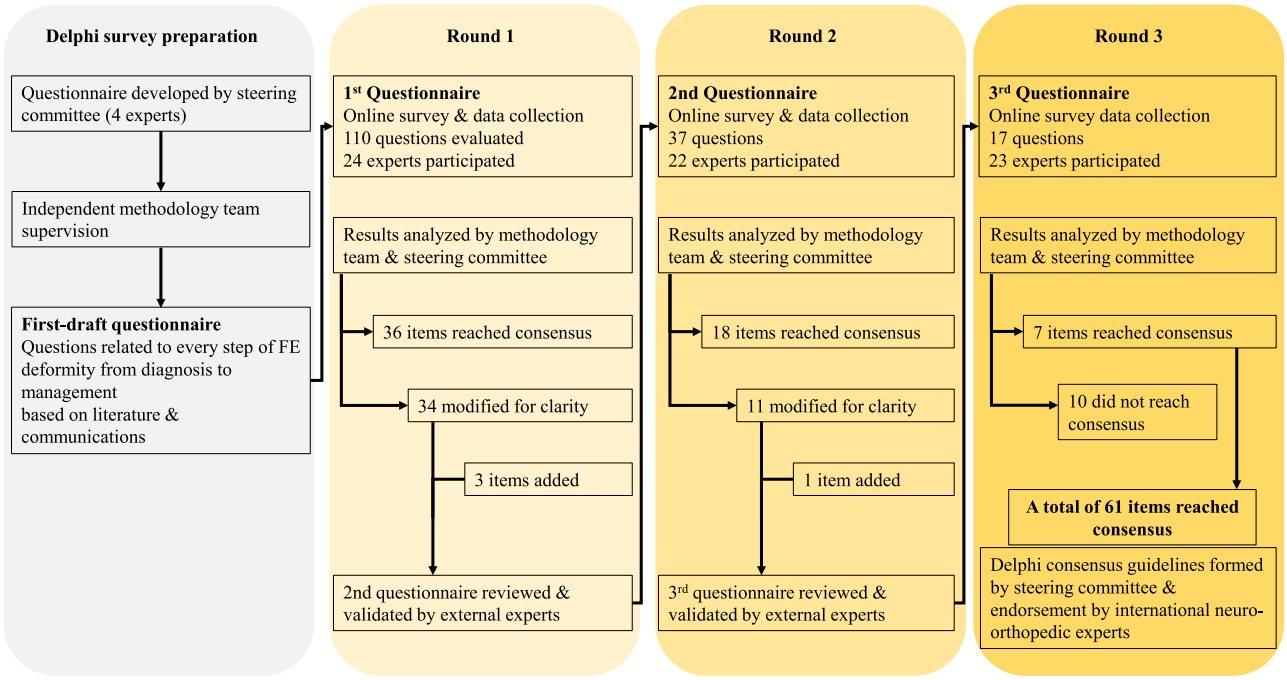

Fig. 1. Delphi process.

Instrumental assessment approaches

Radiological examination was recommended for preoperative assessment of non-correctable FE deformity, particularly to evaluate joint structures and exclude neurogenic heterotopic ossification (Table 1). This imaging provided essential information for surgical planning and prognostic assessment.

Three-Dimensional Movement Analysis of the upper limb was also supported as a complementary objective assessment prior to treatment decision-making. This objective assessment provided detailed biomechanical information, complementing clinical examination and contributing to treatment planning precision.

However, dynamic multi-channel electroneuromyography, a technique that assesses muscle activity during upper-limb movements, did not achieve consensus for routine use in managing FE deformity. The lack of consensus suggested that while the technique may have potential research applications, it lacked routine clinical utility (Table 2).

Treatment selection and sequencing

- *Primary intervention approaches*

For fully correctable FE deformity caused by muscle overactivity, expert consensus strongly supported botulinum toxin type A (BoNT A) injections and physical therapy as first-line medical treatments targeting muscles involved in the deformity. Surgery was not recommended as the initial intervention.

However, 50% of participants stated that sometimes partially- or non-correctable FE deformities due to soft-tissue contractures, associated or not with muscle overactivity, may have required surgery as a primary treatment. Oral antispasmodic medications were generally not recommended as first-line therapy, particularly in partially or non-correctable deformities (Table 3).

- *Preoperative assessment requirements*

Universal expert consensus was established on the necessity of preoperative evaluation by a physical and rehabilitation medicine physician when considering surgical intervention.

Interdisciplinary consultations or meetings received strong support for determining surgical necessity, specifying procedural approaches, and organizing perioperative care. Expert consensus emphasized the active participation of individuals with FE deformity in therapeutic decision-making during consultations. Additionally, formal agreements between caregivers, patients, or legal representatives must be established to define therapeutic goals before surgery (Table 3).

Table 2
Diagnostic evaluation and assessment of flexed elbow (FE) deformity.

Domain	Item	Central tendency (range/IQR)	% agreement	Consensus
Muscles involved	*Brachialis* – 1st position	–	62%	No
	Biceps brachii – 2nd position	–	62%	No
	Brachioradialis – 3rd position	–	86%	Yes
Clinical exam	Functional volitional contraction of elbow flexors	Mean 8.7 (7–10)	100%	Yes
	Analytical elbow flexors contraction	Mean 6.7 (2–10)	>80%	Yes
	Differentiate overactivity vs contracture	–	96%	Yes
	Triceps assessment before surgery	–	96%	Yes
Diagnostic nerve blocks	Musculocutaneous nerve block	–	96%	Yes
	Radial nerve block	–	56%	No
Instrumental assessment	Radiological examination	–	88%	Yes
	3-D movement analysis	–	81%	Yes
	Dynamic multichannel ENMG	–	46%	No

Table 3
Treatment strategy, surgical management, risks, and postoperative care.

Domain	Item	% agreement	Consensus
Initial treatment			
Fully correctable FE	BoNT-A	96%	Yes
	Physical therapy	96%	Yes
	Surgery as first-line	18%	No
	Oral antispasmodics not first-line	78%	No
Partial/non-correctable FE	Surgery as first-line	50%	No
	Oral antispasmodics not first-line	91%	Yes
Preoperative requirements	PMR physician assessment	100%	Yes
	Multidisciplinary consultation	92%	Yes
	Patient involvement in therapeutic decision	96%	Yes
	Formal preoperative agreement	91%	Yes
Surgical indications	Surgery within 1 year post-CNS lesion	91%	Yes
	Musculocutaneous neurotomy (correctable FE)	83%	Yes
	Soft-tissue surgery (contracture)	95%	Yes
	Neurotomy alone (partial/non-correctable FE)	14%	No
	Joint procedures (arthrodesis)	4%	No
	Bone procedures (osteotomy)	0%	No
Technical aspects	Open tendon/muscle lengthening	91%	Yes
	Percutaneous lengthening	88%	Yes
	PMR-performed percutaneous tenotomy	96%	Yes
	Open procedure by surgeons	83%	Yes
	Avoid multi-limb surgery	83%	Yes
Goals & risks	Full extension not required	96%	Yes
	Smoking not a contraindication	83%	Yes
	No nicotine screening	83%	Yes
	Bacteriuria not a contraindication	87%	Yes
Postoperative care	Hematoma main complication	88%	Yes
	Early organization of post-op care	83%	Yes
	Systematic PMR follow-up	88%	Yes
	Postoperative BoNT injections if needed	>80%	Yes

Surgical management approaches

- *Timing considerations*

Surgery for FE deformity could be performed within the 1st year after central nervous system damage, independent of neurologic and functional recovery after an acquired brain injury (Table 3).

- *Surgical treatment*

In cases of fully correctable FE deformity linked to muscle overactivity, surgery on the *musculocutaneous* nerve could be considered to address the muscle overactivity causing FE deformity. There was no consensus concerning neurotomy of other nerves.

For partially- and non-correctable FE deformity caused by soft-tissue contractures, surgical procedure on soft tissues (ie, tenotomy, tendon or muscle lengthening) received strong expert endorsement. Musculocutaneous neurotomy could be performed during the same surgery in cases of muscle overactivity contributing to a partially and non-correctable FE deformity, whereas neurotomy alone did not achieve consensus.

There was no consensus concerning the indication of joint and/or bone remodeling procedures (arthrodesis) (Table 3).

- *Surgical goals and expectations*

Expert consensus established that complete elbow extension is not necessary regardless of surgical goals (hygienic or functional). However, 75% of participants considered functional objectives requiring <40° residual elbow flexion, while surgery for hygienic purposes could tolerate residual elbow flexion between 40° and 60°

Consensus was not achieved regarding indications for joint and/or bone remodeling procedures such as arthrodesis, suggesting these represent individualized decisions requiring case-specific evaluation (Table 3).

- *Technical considerations*

Musculo-tendinous lengthening procedures could be performed using open surgical approaches or percutaneous needle procedures, depending on the targeted tendon structure. Expert consensus supported physical and rehabilitation medicine physicians performing simple percutaneous tenotomies after appropriate structured training. However, open surgical tenotomy, neurotomy, tendon lengthening, and joint procedures required surgical specialist expertise (Table 3).

Experts discouraged procedures on multiple limbs (bilateral FE deformity and/or lower-limb deformities) during single surgical sessions when individuals present with multiple joint deformities, emphasizing staged approaches for complex cases (Table 3).

Risk management and contraindications

Smoking, a positive nicotine urine screening, and asymptomatic bacteriuria were not considered contraindications to surgery, although no consensus was achieved regarding surgery in documented urinary tract infections or arterial insufficiency, indicating individualized risk-benefit assessment requirements (Table 3).

Post-surgical management

Consensus was not achieved regarding the timing of post-surgical immobilization depending on the type of surgery, suggesting individualized protocols based on specific interventions and patient factors.

Concerning post-surgical complications, hematoma was considered by the experts to be the main complication unlike infection and wound healing.

Early organization of post-surgical care (convalescent home, rehabilitation center, or physiotherapy at home) should be arranged as soon as the FE surgery is planned. Follow-up by a PMR specialist should be systematically established, or continuous after surgery (Table 3).

All experts agreed that BoNT injections could be proposed postoperatively, either to treat overactive muscles responsible for troublesome abnormal joint posture in another part of the body, and/or overactive muscles newly identified in the FE deformity after surgery (eg, accessory elbow flexor muscles) (Table 3).

Discussion

Clinical significance and innovation

This international Delphi study provides the first interdisciplinary and international consensus specifically addressing the assessment and management of poststroke FE deformity. The main contribution of this work is the formalization of a shared clinical reasoning framework integrating functional assessment, diagnostic clarification, and treatment sequencing across medical and surgical disciplines.

Clinical exam of the upper limb as the cornerstone of decision-making

One of the strongest consensus was the primacy of functional assessment over isolated analytical testing. Functional assessment also includes assessing volitional control and examining FE deformity utility during functional activities of daily living, including eating, grooming, dressing, reaching objects, and walking. Experts agreed that treatment decisions must be driven by the functional impact of FE deformity on daily activities. This finding aligns with previous work emphasizing goal-oriented management of upper-limb spasticity rather than impairment-based approaches [4]. The present consensus reinforces that a FE posture may be either disabling or functionally useful, and that this distinction must be explicitly explored before intervention. The consensus further highlights the need to assess deformity in multiple contexts and at different times of the day, acknowledging the dynamic nature of muscle overactivity [8,14,13]. This reinforces existing rehabilitation paradigms but formalizes them within a structured decision-making process applicable to non-specialist clinicians.

Concerning the muscular determinants of FE deformity, although no consensus was reached regarding a strict hierarchy among elbow flexors, expert opinions consistently identified the *brachialis* as the muscle most frequently involved. Despite disagreements among experts regarding the relative strength of these muscles in elbow flexion, their anatomical and biomechanical characteristics allow inference of their respective roles in FE deformity [12]. The *brachialis* is a monoarticular, pennate muscle with a short lever arm, acting as a pure elbow flexor. In contrast, the *biceps brachii* is a biarticular, fusiform, digastric muscle with a long lever arm, contributing to both elbow and shoulder flexion and functioning as a powerful forearm supinator, making it an unlikely driver of a combined flexion−pronation deformity. The *brachioradialis*, although monoarticular and acting solely on the elbow, also has a relatively long lever arm. Based on biomechanical analysis, Genêt et al. concluded that the *brachialis* is the strongest elbow flexor, ahead of the *biceps brachii* and the *brachioradialis* [12].

Differentiating muscle overactivity from soft-tissue contracture to determine FE deformity correctability

A major result of this Delphi process is the unanimous agreement that differentiating muscle overactivity from fixed soft-tissue contracture is mandatory before any treatment. The consensus underscores the primacy of clinical examination, with diagnostic motor nerve blocks used when necessary. As described in the literature, selective motor nerve blocks of the *musculocutaneous* nerve can help to determine target muscles involved in FE deformity and help to establish attainable therapeutic goals with the patient [12]. Also, diagnostic motor nerve blocks are helpful to assess the impact of treatments such as botulinum toxin or neurotomy on upper-limb function and to assess whether the individual will not lose any function post-treatment [9,24]. Motor nerve blocks can be helpful to minimize the risk of hypercorrection of the deformity by unmasking muscle activity of the antagonists [25]. The absence of consensus regarding radial nerve blocks for the *brachioradialis* likely reflects variability in clinical experience and deformity patterns rather than a lack of theoretical relevance.

Instrumental assessment: complementary, not systematic

Experts agreed that radiological imaging is indicated in non-correctable deformities, particularly to exclude neurogenic heterotopic ossification and assess joint integrity [26]. This result is consistent with current neuro-orthopedic practice and supports selective rather than systematic imaging.

Three-dimensional motion analysis was endorsed as a complementary tool in selected cases, whereas dynamic multi-channel electromyography did not reach consensus for routine use. This finding suggests that while advanced instrumental tools may enhance precision in expert centers, clinical examination remains the cornerstone of decision-making.

Interdisciplinary care model

Expert consensus emphasizes interdisciplinary collaborative consultation for preoperative assessment, including physicians, surgeons, and individuals presenting with disabling FE deformities. Family members, caregivers, and rehabilitation team members can participate in consultations, and provide functional impact information regarding FE deformity [27,28]. Discussion between the interdisciplinary team, the patient, and their family or caregivers is important to identify treatable problems affecting the patient's quality of life [4,27,29,30]. Interdisciplinary consultations assess the characteristics of the deformity, ascertain the impact of the treatment on the activities of daily living, and can also be used to propose complementary treatment strategies. In addition, interdisciplinary consultation allows surgeons, physicians, and the rehabilitation team to discuss various therapeutic strategies with the person receiving care and identify the option best aligned with their goals. This plan can then be formalized as an agreement between the patient and caregivers to help avoid misunderstanding and disappointment.

Improvement can only result from a coordinated FE deformity management strategy, which depends on the quality of the medico-surgical network. While an interdisciplinary framework has been lacking to date, our Delphi-defined position lays the foundation for the interdisciplinary management of FE deformity.

Treatment algorithm development

First-line treatment for correctable FE deformity caused by muscle overactivity relies on BoNT and rehabilitation interventions. Musculocutaneous nerve surgery can be proposed subsequently. However, when deformities become non-correctable (partially- or non-correctable) due to soft-tissue contractures, surgical approaches involving tendon lengthening can sometimes be performed as first-line treatment and may be conducted within the 1st year following acquired brain injury.

When muscle overactivity and soft-tissue contractures coexist, tendon lengthening and neurotomy can be performed during the same surgical procedure. Soft-tissue surgery should be prioritized over joint surgery (arthrodesis), as it is considered less risky, less irreversible, easier to perform, requires less postoperative immobilization, and enables earlier rehabilitation [27,31]. Tendon lengthening procedures can be performed percutaneously or through open surgical approaches, depending on FE deformity characteristics and treatment objectives [30,32,33]. Innovative techniques such as cryoneurotomy [34] and percutaneous laser surgery are emerging to treat abnormal joint posture in hemiplegic or hemiparetic individuals. These techniques are promising, but their efficacy in the long term has not been evaluated yet.

Study limitations

More than half of the participants in the study were PMR doctors, which could introduce an imbalance and bias in the answers among surgeons and medical doctors. Nevertheless, the international and interdisciplinary composition of the panel strengthens the external validity of the findings and reflects real-world clinical practice in specialized neuro-orthopedic networks [23]. The questions in this study could not always be formulated in strict accordance with standard Delphi methodology using Likert-scale items. Although open-ended questions are not optimal for achieving consensus, they are valuable for exploring the group's reasoning and informing the development of subsequent questionnaires through the addition, removal, or reformulation of items. For more specific topics, descriptive multiple-choice questions and binary (yes/no) questions were used (Appendix A).

Patient-reported opinions from individuals with spastic elbow were not collected in this study, in line with the methodological framework described by Nguyen et al. [35]. Consequently, the present work reflects expert consensus rather than formal clinical recommendations. Further studies incorporating patient perspectives will be required to develop robust international recommendations.

Future research should focus on areas where consensus was not achieved, incorporate patient perspectives, and evaluate the clinical impact of implementing these consensus-based pathways across different healthcare systems [35].

Conclusion

This study addresses the critical lack of consensus regarding the management of FE deformity in poststroke populations. Using Delphi methodology, we established consensus on key management steps, including diagnosis, assessment, and treatment approaches for individuals with hemiplegic or hemiparetic FE deformity.

The consensus emphasizes the importance of comprehensive functional assessment before treatment decisions. It also highlights the need for careful differentiation between muscle overactivity and soft-tissue contractures to guide intervention selection. Interdisciplinary collaboration is crucial for optimal outcomes, and structured preoperative assessments and formal goal-setting requirements are essential for surgical candidates.

Treatment sequencing for FE deformity follows a pattern of correctable versus non-correctable deformities. BoNT and physical therapy are the first-line interventions for correctable cases, while surgical approaches may be necessary for non-correctable deformities. Early intervention within the 1st year post-injury is strongly recommended, and patient-centered goal setting should be emphasized throughout the management process.

By disseminating this expert-derived consensus information to rehabilitation care providers, appropriate identification and referral of individuals with FE deformity to expert networks can be facilitated. This optimization of functional recovery and improved autonomy, coupled with social integration, can be achieved. This work provides practical guidance for implementing standardized care approaches across diverse healthcare settings.

Future research should address areas where consensus was not achieved, develop implementation strategies for expert opinions across different healthcare systems, and evaluate outcomes following consensus-based management approaches. This foundation enables continued refinement of FE deformity management protocols through systematic evidence accumulation and expert collaboration.

Author contribution

Conception and design of the study: FG. Steering committee: FG, EA, FD, LG. Experts who answer questionnaires: MS, LG, TD, TG, SC, PM, PW, RR, TW, AE, MAK, FM, PZ, AP, FC, BC, NSN, CF, AY, BP, PH, SV, PR, RD, PD, AS, EA, FG. Acquisition and analysis of data: MS, FG. Drafting a significant portion of the manuscript or figures: MS, FG.

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Use of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT, OpenAI to improve the clarity, grammar, and overall readability of the English language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Data availability

Data will be made available on request.

Declaration of competing interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.rehab.2026.102136.

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