EAJNS East African Journal of Neurological Sciences
Official journal of East African Association of Neurological Surgeons

Original Article EAJNS 5(2): 72-79

Functional and Surgical Outcomes of Intrathecal Baclofen Therapy: A Retrospective Study at a Tertiary Neurosurgical Centre in Upper Egypt (2022–2024)

Authors: Mohamed Khallaf[1], Ahmed Zanaty[1], Osama Ramadan[1], Farrag Mohammad[1]

Affiliations: Faculty of Medicine, Assiut University, Assiut, Egypt

Corresponding author: Ahmed Zanaty. Email: Ahmedzanaty@med.aun.edu.eg

Received: 30-09-2025; Revised: 21-10-2025; Accepted: 24-10-2025

DOI: https://dx.doi.org/10.4314/eajns.v5i2.2

ABSTRACT

Background: Intrathecal baclofen (ITB) pump therapy is a well-established intervention for refractory spasticity. Its effectiveness depends not only on pharmacological action but also on surgical precision and multidisciplinary care. **Methodology:** We retrospectively reviewed 15 adult patients (mean age 45.3 ± 11.9 years) with refractory spasticity due to multiple sclerosis (9/15, 60%), cerebral palsy (2/15, 13.3%), hereditary spastic paraparesis (2/15, 13.3%), spinocerebellar degeneration (1/15, 6.7%), and stroke (1/15, 6.7%). Inclusion criteria: age ≥18 years, central spasticity unresponsive to oral medications and physiotherapy, significant functional impairment, and positive ITB test dose. Exclusion criteria: age <18 years, severe fixed contractures, uncontrolled infection, progressive systemic illness precluding surgery, or negative test trial. Functional outcomes were assessed at baseline, 6 months, and 12 months using the Modified Ashworth Scale (MAS), Penn Spasm Scale (PSS), Numeric Pain Scale (NPS), and Gross Motor Function Classification System (GMFCS). Surgical details and complications were also recorded. **Results:** Spasticity and pain improved significantly and consistently across measures. The Modified Ashworth Scale (MAS) decreased from 2.9 ± 0.9 to 1.1 ± 0.6 at 12 months, indicating a mean reduction of 1.8 points (95% CI, 1.2 - 2.4; $p < 0.001$). Spasm frequency (PSS) declined by 1.6 points (95% CI, 1.0–2.1; $p < 0.001$), and pain intensity (NPS) fell by 4.3 points (95% CI, 3.4–5.2; $p < 0.001$). Nearly half of the cohort (47%) achieved an improvement of at least one GMFCS level, and 67% surpassed their preoperative functional goals on Goal Attainment Scaling (GAS). Regression analysis revealed that a younger age (β = –0.03, 95% CI –0.05 to –0.01; p = 0.006) and a shorter disease duration (β = –0.02, 95% CI –0.04 to –0.001; p = 0.041) are significant predictors of increased tone reduction. Complications occurred in 27% of patients, predominantly catheter-related, with no systemic adverse events. **Conclusion:** ITB pump implantation delivers sustained reduction in spasticity, spasms, and pain, alongside meaningful functional gains in mobility and caregiving ease. Surgical techniques—particularly pump pocket creation, catheter stabilisation, and wound closure—were shown to be critical in minimising complications and preserving long-term efficacy. Beyond scale-based improvements, patients experienced enhanced comfort, improved sleep, and reduced caregiver burden.

Keywords: Spasticity, Baclofen, pump implantation, Surgical Outcomes, Functional Neurosurgery. Spinocerebellar Degeneration

INTRODUCTION

Spasticity, a hallmark of the upper motor neuron syndrome, is a common clinical manifestation. While it may occasionally provide functional benefit by compensating for weakness, it is more often

detrimental—restricting mobility and, in severe cases, leading to fixed contractures and deformities. In many patients, spasticity exerts both beneficial and harmful effects simultaneously (1).

The epidemiology of spasticity varies with the type and severity of central nervous system injury. It affects approximately 65–93% of patients with chronic spinal cord injury (2), about 25–27% of stroke survivors (3), and over 80% of individuals with multiple sclerosis (4). In cerebral palsy, the spastic subtype accounts for approximately 80–90% of all presentations (5).

Management strategies exist along a continuum from non-invasive pharmacologic and rehabilitative approaches to invasive neurosurgical interventions, all aimed at mitigating spasticity and improving quality of life. When spasticity becomes severe and further aggravates disability, functional neurosurgery provides an important therapeutic option.

Among neurosurgical options, intrathecal baclofen (ITB) therapy is a key intervention for severe, treatment-refractory spasticity due to cerebral palsy, multiple sclerosis, spinal cord injury, or stroke. Baclofen, a GABA-B receptor agonist, reduces excitatory neurotransmission in the spinal cord, lowering tone and spasms. Because oral administration is limited by poor central penetration and systemic side effects, intrathecal delivery provides targeted spinal action at <1% of the oral dose. The system comprises a programmable subcutaneous pump connected to an intrathecal catheter, delivering continuous baclofen infusion directly into the cerebrospinal fluid. Implantation involves lumbar catheter insertion, subcutaneous tunneling, and pump fixation in the abdominal wall. Common complications include catheter malfunction, infection, CSF leakage, and withdrawal from drug interruption. Despite these risks, ITB offers durable, adjustable, and well-tolerated control of generalized spasticity (6).

Despite its widespread use, few studies have jointly examined the surgical and functional outcomes of intrathecal baclofen (ITB) therapy. The primary objective of this study was to evaluate the within-patient change in spasticity, measured by the Modified Ashworth Scale (MAS), at 12 months following ITB pump implantation. Secondary objectives included assessment of changes in spasm frequency (Penn Spasm Scale, PSS), pain intensity (Numeric Pain Scale, NPS), functional mobility (Gross Motor Function Classification System, GMFCS), and goal attainment (Goal Attainment Scaling, GAS), as well as characterization of the surgical complication profile.

METHODOLOGY

Study Design

This was a retrospective single-cohort study utilizing clinical data collected between 2022 and 2024 at the Neurosurgery Department of Assiut University Hospital, a tertiary referral center in Upper Egypt. The study aimed to assess the outcomes of intrathecal baclofen (ITB) pump implantation in patients with chronic spasticity unresponsive to conservative measures. All relevant demographic, functional, surgical, and follow-up data were extracted from institutional records and analyzed to evaluate both clinical efficacy and procedure-related safety.

Patient Selection

The study included adults (≥18 years) with chronic spasticity of central origin who had not improved with optimized oral therapy and physiotherapy. All patients were functionally impaired, deemed suitable candidates for intrathecal baclofen (ITB) therapy after multidisciplinary evaluation, and had demonstrated a positive response to an intrathecal baclofen screening trial (using a bolus of 50 µg administered via lumbar puncture. Muscle tone and spasm frequency were assessed at 4 and 6 hours post-injection using MAS and PSS. A ≥1-point MAS reduction or clear functional ease without major adverse effects (hypotonia, sedation, respiratory depression) defined a positive response. Patients with inadequate response or intolerable side effects were excluded from implantation).

Surgical Technique and Perioperative Protocol:

Peri-operative bundle: All procedures were performed under strict aseptic conditions using chlorhexidine–alcohol skin preparation and full sterile draping. A single intravenous dose of cefazolin (2 g) was administered 30 minutes before incision. A glove and instrument change was performed before handling the pump and catheter components.

Hardware: Medtronic SynchroMed II programmable pump (20 mL reservoir) connected to a silicone intrathecal catheter (Ascenda).

Catheter tip level: Targeted to L1-2 , Position confirmed by free CSF egress and intra-operative fluoroscopy. The catheter was anchored with a double-suture technique at the fascial entry and a strain-relief loop.

Pocket creation: Pump placed subcutaneously in the left lower abdominal quadrant in most cases, chosen for patient comfort and accessibility. Pocket depth averaged 1.5–2 cm, closed in two layers (absorbable subcuticular sutures plus skin adhesive) to reduce tension and pressure injury.

Baclofen concentration and dosing: The pump reservoir contained 20 mL of baclofen solution, with each millilitre containing 2000 µg of baclofen (concentration 2000 µg/mL). The initial infusion dose was 200 µg/day, adjusted in 10–20% increments at each follow-up visit according to tone reduction and side-effect profile. Dose titration was typically performed every six weeks, based on multidisciplinary review and patient response. Pump refills were scheduled at three-month intervals, and alarm thresholds were set in accordance with manufacturer specifications.

Post-operative care: Routine evaluation on postoperative day 1 and week 6. Wound checks performed at each refill. Imaging (X-ray or CT myelogram) triggered early if spasticity recurred or drug delivery failure was suspected.

Outcome Measures

Assessments were carried out preoperatively, and at 6 and 12 months post-implantation. The primary outcome was reduction in spasticity measured by the Modified Ashworth Scale (MAS). Secondary outcomes included spasm frequency using the Penn Spasm Scale (PSS), pain intensity with the Numeric Pain Scale (NPS), functional mobility by the Gross Motor Function Classification System (GMFCS), and functional goal achievement using Goal Attainment Scaling (GAS).

Although originally developed for children with cerebral palsy, the GMFCS was applied here descriptively to indicate mobility and care dependence in adults with chronic spasticity.

Evaluations were conducted in the spasticity clinic by a multidisciplinary team comprising a neurologist, neurosurgeon, rheumatologist, physiotherapist, and pain medicine specialist. All assessors were experienced in spasticity management and trained in standardized scoring of MAS, PSS, and NPS. As the evaluating clinicians were aware of the treatment status, blinding was not feasible, and a potential observer bias is acknowledged.

Statistical Analysis

Continuous variables (age, disease duration, MAS, PSS, NPS, and GMFCS) were summarized as mean ± standard deviation or median (interquartile range) according to data distribution. Within-patient changes in these measures were evaluated over time, with effect sizes and 95% confidence intervals reported to indicate the precision of estimates. Normality checks guided the choice of parametric or non-parametric testing. Linear regression was used to identify predictors of MAS improvement, including age, disease duration, and aetiology, with model fit expressed by R^2. Analyses followed a predefined outcome hierarchy (primary: MAS; secondary: PSS, NPS, GMFCS, GAS). Missing data were minimal and handled pairwise. Statistical significance was set at $p < 0.05$.

Ethics Approval

This study was approved by the Institutional Review Board of Assiut University Hospital (IRB No. **04-2023-100028**). Written informed consent was obtained from all participants prior to intrathecal baclofen pump implantation and for the use of anonymized clinical data in research. All data were de-identified prior to analysis to maintain patient confidentiality and privacy in accordance with institutional and international ethical standards.

RESULTS

Demographics

We reviewed 15 patients (9 males, 6 females) with a mean age of 45.3 ± 11.9 years (range 20–66) and a mean disease duration of 14.3 ± 7.2 years. The aetiologies were multiple sclerosis in 9/15 (60.0%), hereditary spastic paraparesis in 2/15 (13.3%), cerebral palsy in 2/15 (13.3%), and single cases of spinocerebellar degeneration in 1/15 (6.7%) and stroke in 1/15 (6.7%).

Pre-Intervention Clinical Evaluation

The cohort comprised 15 patients with severe, treatment-refractory spasticity. Nearly half (46.7%) were classified as GMFCS Level IV and 20% as

Level V, reflecting major functional dependence. Baseline assessments confirmed a high symptom burden, with mean MAS 2.9 ± 0.9, PSS 2.8 ± 0.6, and NPS 7.4 ± 1.3. In addition, 60% were categorized as Low-Level Performers in chair-to-bed transfers, indicating significant limitations in daily living activities.

Primary Outcome: (Modified Ashworth Scale)

The Modified Ashworth Scale (MAS) showed a marked and durable reduction in spasticity, decreasing from 2.9 ± 0.9 at baseline to 1.4 ± 0.7 at six months and 1.1 ± 0.6 at twelve months, a mean improvement of 1.8 points (95% CI 1.2–2.4). Overall, 87% of patients improved, with several achieving near-normal tone. The magnitude and consistency of these gains corresponded to a large within-subject standardized effect (Cohen's dz = 1.2), indicating substantial and sustained tone relief across the cohort (Table 1).

Regression analysis of the primary outcome

Younger age and shorter disease duration independently predicted greater reductions in spasticity, while the diagnostic category showed no significant association with outcome. The regression model demonstrated good explanatory power (R^2 = 0.58) with satisfactory fit and no evidence of collinearity or residual bias. In the model, the predictor represents the variable tested for its impact on improvement in the Modified Ashworth Scale (MAS); the coefficient (β) indicates the direction and magnitude of the effect; the 95% confidence interval (CI) provides the range within which the true coefficient is likely to lie; and the p-value indicates statistical significance, with $p < 0.05$ considered significant.

Secondary Outcome

Spasm frequency (PSS) and pain intensity (NPS) both improved materially following ITB therapy. Mean PSS scores declined from 2.8 ± 0.6 to 1.2 ± 0.7 at 12 months, a mean reduction of 1.6 points (95% CI 1.0–2.1). Pain scores decreased from 7.4 ± 1.3 to 3.1 ± 1.4, a mean reduction of 4.3 points (95% CI 3.4–5.2). Data met normality assumptions, supporting parametric analysis. Both measures showed consistent improvement across diagnostic subgroups, with lesser change in two patients who experienced catheter-related complications.

Seven of fifteen patients (46.7%) improved by at least one GMFCS level, most often from Level IV to III, reflecting better sitting balance, transfers, and reduced caregiver dependence. Although designed for paediatric cerebral palsy, the GMFCS was used descriptively to represent mobility and care needs in adults with chronic spasticity.

Goal Attainment Scaling demonstrated meaningful individual progress: 10 of 15 patients (66.7%) exceeded goals, 3 (20%) met goals, and 2 (13.3%) underperformed. The median GAS T-score was 56 (IQR 50–62), indicating above-expected performance overall. Notably, both patients with underperformance experienced postoperative complications, underscoring the impact of surgical integrity on functional outcomes.

Postoperative Complications

Four of fifteen patients (26.7%) experienced postoperative complications, all within the first postoperative year. Two catheter retractions occurred at 3 and 5 months, presenting as gradual loss of tone control. One catheter dislocation at 8 months resulted in rebound spasticity and required surgical revision. A superficial pocket infection developed at 10 months, initially treated conservatively but later necessitating pump explantation and re-implantation after resolution. No mechanical pump failures or systemic infections were observed.

All affected patients were at GMFCS Levels IV–V, suggesting increased susceptibility in those with severe functional limitations. There was no consistent clustering of events by operative time, pocket plane, catheter tip level, or refill interval. The Kaplan–Meier analysis demonstrated freedom from revision or infection of 93% at 6 months and 73% at 12 months.

Figure 1: *Participant Flow diagram 2022-2024*

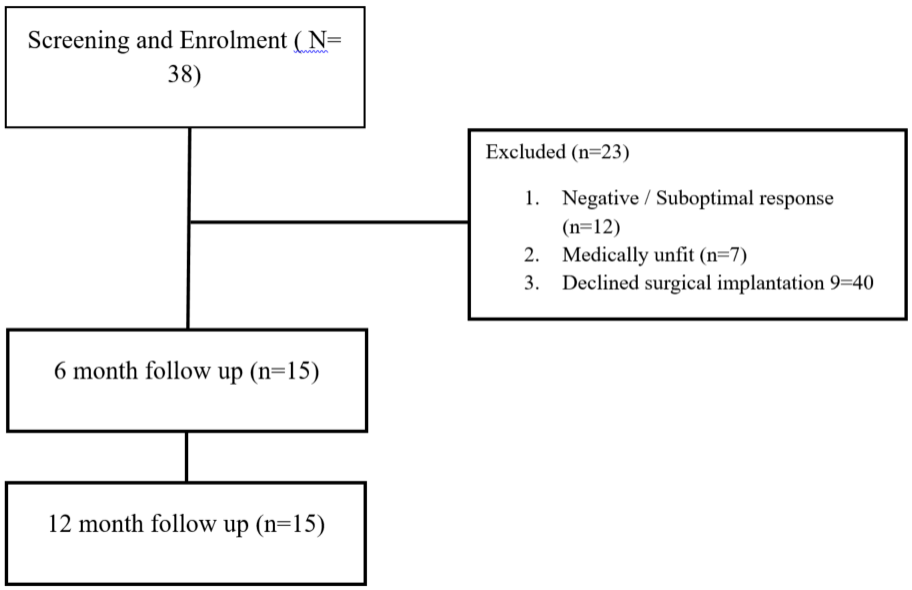

Table (1): *Reduction in Spasticity (Modified Ashworth Scale) Over Time*

Time Point	Mean ± SD	Clinical Interpretation	Statistical Comparison (Bonferroni-adjusted)
Preoperative	2.9 ± 0.9	Moderate to marked spasticity	—
6-month follow-up	1.4 ± 0.7	Mild spasticity	Significant reduction compared with baseline ($p < 0.001$)
12-month follow-up	1.1 ± 0.6	Minimal spasticity	Significant reduction compared with baseline ($p < 0.001$); no significant difference compared with 6 months ($p = 0.12$)

Table 2: *Regression Analysis of Predictors of Spasticity Reduction (MAS Improvement)*

Predictor	β (Coefficient)	95% Confidence Interval	p-value	Interpretation
Age (years)	–0.03	–0.05 to –0.01	0.006	Younger age associated with greater MAS improvement
Duration of spasticity (years)	–0.02	–0.04 to –0.001	0.041	Shorter disease duration associated with greater response
CP vs MS	+0.22	–0.23 to +0.67	0.317	No significant difference
HSP vs MS	+0.11	–0.18 to +0.40	0.457	Non-significant trend toward better improvement
Stroke vs MS	–0.19	–0.62 to +0.24	0.384	Non-significant trend toward less improvement
Spinocerebellar vs MS	–0.14	–0.50 to +0.21	0.429	No significant difference

Table (3): *Changes in Spasm Frequency (Penn Spasm Scale) and Pain Intensity (Numeric Pain Scale) at Follow-Up*

Time Point	PSS (Mean ± SD)	PSS Interpretation	NPS (Mean ± SD)	NPS Interpretation
Preoperative	2.8 ± 0.6	Frequent spasms	7.4 ± 1.3	Severe pain
6-Month Follow-Up	1.5 ± 0.7	Intermittent spasms	4.1 ± 1.6	Moderate pain
12-Month Follow-Up	1.2 ± 0.7	Rare spasms	3.1 ± 1.4	Mild pain
Improvement	↓	Reduced spasm frequency	↓	Pain relief maintained

Table (4): *Postoperative Complications Following Intrathecal Baclofen Pump Implantation*

Complication	n (%)	Description	Management
Catheter Retraction	2 (13.3%)	Catheter pulled back, causing suboptimal intrathecal baclofen delivery and poor clinical gains.	Reprogramming of pump settings; monitored catheter position and CSF dynamics.
Catheter Dislocation	1 (6.7%)	Catheter tip displaced, leading to rebound spasticity.	Surgical revision to reposition catheter and restore function.
Surgical Site Infection	1 (6.7%)	Local erythema and discharge at pump pocket site.	Initial conservative antibiotic/wound care; eventual pump removal and later reinsertion.

DISCUSSION

The cohort (mean age 45.3 ± 11.9 years) showed a male predominance (60%), consistent with prior observations that chronic spasticity and its functional impact are more prevalent and severe among male patients. An average disease duration of 14.3 years highlights the chronic nature of impairment, a key factor influencing responsiveness to intrathecal baclofen (ITB). Prolonged disease often limits reversibility due to contractures and central sensitization. Similar findings reported by Ammar (2018), were associated with attenuated therapeutic response in both pediatric and adult groups (7).

Multiple sclerosis accounted for over half of cases (60%), consistent with its high spasticity burden and associated comorbidities that can complicate ITB response. Cerebral palsy and hereditary spastic paraparesis (13.3% each) highlight ITB's value in congenital and hereditary conditions, while post-stroke, traumatic brain injury, and spinocerebellar degeneration represented the remainder. This diagnostic diversity reinforces ITB's versatility across progressive and static disorders, while also reflecting its frequent late use after failure of systemic medications and rehabilitation—emphasizing the need for structured test-dose protocols.

Nearly half of the cohort (46.7%) were classified as GMFCS Level IV and 20% as Level V, reflecting profound mobility limitations and dependency on powered mobility or full caregiver assistance. This severity is typical for ITB candidates, where conventional therapies have failed to achieve comfort or independence. Albright et al. highlighted that patients at GMFCS Levels IV–V derive the greatest symptomatic relief from ITB, particularly regarding ease of care and reduction of painful spasms. Baseline symptom scores confirmed a high burden: MAS (2.9 ± 0.9), PSS (2.8 ± 0.6), and NPS (7.4 ± 1.3), aligning with prior reports from adult ITB cohorts such as Meythaler et al., where MAS values ranged 2.5–3.5 and NPS > 6 prior to implantation (8).

Following ITB pump implantation, MAS decreased significantly from 2.9 ± 0.9 to 1.1 ± 0.6 ($p < 0.001$), representing a mean 1.8-point reduction, consistent with prior studies including Van der Gaag et al., who reported similar effects in nursing home residents (9). This reduction supports the reproducible association between ITB and tone control. Similarly, PSS scores improved from 2.8 ± 0.6 to 1.2 ± 0.7 ($p < 0.001$), reflecting a 57% reduction in spasm frequency, most notable in MS and HSP patients. Comparable outcomes were described by Mathur et al. and Skogberg et al., confirming ITB's dual effect on tone suppression and reflex hyperexcitability (10,11).

NPS scores improved markedly from 7.4 ± 1.3 to 3.1 ± 1.4 ($p < 0.001$), signifying a 58% relative reduction in subjective pain burden. This aligns with reports by Mathur et al., who observed sustained pain relief in long-term ITB recipients.(11) The observed dissociation between pain reduction and MAS or GMFCS change suggests that analgesic benefit may occur through modulation of spinal nociceptive pathways, rather than solely through tone suppression, supporting a multidimensional mechanism of action as described by Kaye et al. (12).

Regression analysis showed younger age and shorter disease duration were associated with greater MAS reductions, reflecting enhanced neuroplasticity and musculoskeletal adaptability in early-stage spasticity. The model explained 58% of treatment variance ($R^2 = 0.58$), aligning with findings from Otero-Luisa et al. and Masrour et al. who identified pre-implantation responsiveness as a key prognostic marker (13,14). Etiology did not significantly influence MAS reduction, although subtle trends favored HSP over stroke-related spasticity. Importantly, patients with fixed contractures or catheter mispositioning (as described by Motta et al. and Tiefenbach et al.) showed limited response, highlighting the need for preoperative musculoskeletal evaluation and meticulous surgical technique (15,16).

Almost half the cohort (46.7%) improved by at least one GMFCS level, most commonly from IV to III, indicating enhanced trunk-limb coordination, weight-bearing ability, and transfer independence. These outcomes echo Motta et al., who reported significant GMFM improvements following ITB in children with cerebral palsy (15). Although absolute functional gains may appear modest, Masrour et al. showed that even small improvements are clinically meaningful, reducing caregiver burden and enhancing quality of life (13). Together, these findings reaffirm ITB's multi-domain impact—spasticity, pain, and function—without implying direct causality among them.

Complications and Preventive Measures

In this cohort, 26.7% of patients experienced postoperative complications after ITB pump implantation, consistent with reported rates of 20–30% in comparable populations. Most were catheter-related, including retraction (13.3%) and dislocation (6.7%), both of which impaired baclofen delivery and led to clinical decline. These results parallel Stevenson et al., who identified catheter migration, kinking, and dislodgement as common causes of ITB malfunction requiring reprogramming or revision surgery (14).

Each failure mode identified in our series informed a corresponding operative prevention step that has been incorporated into a proposed surgical safety bundle. Catheter retraction is minimized by adding a second fascial anchor at the entry site, while dislocation or kinking is reduced by ensuring adequate strain-relief coil length before tunneling. In addition, pocket infection is prevented through a two-stage closure technique consisting of an absorbable subcuticular suture followed by skin adhesive to reinforce barrier integrity.

A single case (6.7%) of surgical site infection occurred, initially treated with antibiotics and wound care but ultimately requiring pump removal and delayed reimplantation. This reflects registry findings by Lam et al., who noted infections as the leading cause of unplanned reoperation within 30 days of ITB placement (15). Factors such as immobility, poor nutritional status, and fragile soft tissue—frequent in GMFCS IV–V patients—likely contribute to this risk.

Patient Centered Outcomes

GAS outcomes showed high patient-perceived benefit, with 66.7% exceeding expectations and 20% meeting their stated goals, consistent with Bonouvrie et al. who reported similar rates of goal achievement in cerebral palsy cohorts (16). The two patients scoring –1 were those with postoperative complications, highlighting the link between procedural success and goal attainment, as also noted by Saulino et al. (17). No scores fell below –1, reinforcing the overall safety and tolerability of ITB. GAS thus provides a patient-centered, flexible framework that captures both functional efficacy and subjective satisfaction, underscoring its value in ITB outcome assessment.

The reduction in tone and discomfort appeared to release neuromechanical constraints, enabling latent motor abilities to emerge. Nearly half of the patients improved in GMFCS level, reflecting downstream effects of neural decompression on posture, trunk-limb coordination, and mobility, particularly in those without longstanding contractures. Importantly, these gains were not limited to clinical scores—87% of patients reported meeting or surpassing their personal goals on the GAS, underscoring ITB's alignment with patient priorities by reducing suffering, enhancing autonomy, and restoring dignity.

Non-responders in this cohort were largely linked to catheter-related complications, emphasizing that device integrity is central to therapeutic success.

These cases highlight the need for standardized postoperative imaging, refined surgical technique, and prompt troubleshooting to sustain benefit. Collectively, the findings reinforce ITB as a multidimensional neuromodulatory therapy that improves tone, spasm, pain, function, and quality of life—arguing for its earlier integration into care pathways before irreversible decline from contractures or caregiver burden occurs.

Operative Lessons and Technical Insights

Pump pocket: The left lower abdominal quadrant was preferred to minimize interference with wheelchair joysticks and facilitate right-handed access. A subfascial pocket of moderate depth was favored to reduce prominence and pressure over the pelvic crest, especially in thin patients.

Catheter handling: A braided anchor with non-absorbable suture was used for fascial fixation. The subcutaneous tunnel was kept under mild tension with sufficient slack for strain relief, and fluoroscopic confirmation of lumbar catheter placement was performed intraoperatively.

Early troubleshooting: For suspected withdrawal or overdose, a stepwise approach is recommended—(1) pump interrogation, (2) programmable bolus test, (3) AP and lateral X-rays, (4) catheter dye study or CT myelography if needed, and (5) serum baclofen level correlation when available.

Dose programming: Initial daily dose averaged 100 µg, titrated by 10–20% every 6 weeks to tone and spasm control. In patients with nocturnal spasticity, diurnal variation was applied to increase nighttime delivery.

CONCLUSION

Intrathecal baclofen provided meaningful reductions in tone, spasms, and pain with associated functional gains across a heterogeneous spasticity cohort. Most complications were catheter-related and occurred in GMFCS IV–V patients. Going forward, a standardized post-implant surveillance protocol with early imaging triggers will be adopted to improve safety and treatment durability.

Study Limitations: This study is limited by its small sample size and retrospective design, which may introduce selection and observer bias despite standardized protocols. The heterogeneous etiologies reflect ITB's versatility but add variability. Outcomes were not independently or blindly assessed, and functional evaluation relied on the GMFCS, which is not validated for adults or non–cerebral palsy cases. The 12-month follow-up and potential learning-curve effects from 2022–2024 also constrain long-term interpretation.

Funding: The authors received no financial support from any organization for the submitted work

REFERENCES

1. Sindou M, Brinzeu A, Georgoulis G. Neurosurgical lesioning procedures for spasticity and focal dystonia. Neurophysiology in Neurosurgery: Elsevier; 2020. p. 499–513.
2. Elbasiouny SM, Mushahwar V, McVea DA, et al. Spasticity after spinal cord injury: neuronal mechanisms and current treatment options. *Front Neurol.* 2010;1:149.
3. Zeng H, Chen J, Guo Y, Tan S. Prevalence and risk factors for spasticity after stroke: a systematic review and meta-analysis. *Front Neurol.* 2021;11:616097.
4. Becker WJ, et al. Spasticity in multiple sclerosis: prevalence, impact, and management. *Mult Scler Relat Disord.* 2017;17:9–15.
5. Rosenbaum P, Paneth N, Leviton A, et al. The epidemiology of cerebral palsy: current understanding and future directions. *Front Neurol.* 2021;12:701–709.
6. Albright AL, Ferson SS. Intrathecal baclofen therapy in children. Neurosurgical focus. 2006;21(2):E3.
7. Ammar A. Intrathecal baclofen therapy for treatment of spasticity and dystonia in childhood: University of Nottingham; 2018.
8. Meythaler JM, Steers WD, Tuel SM, Cross LL, Sesco DC, Haworth CS. Intrathecal baclofen in hereditary spastic paraparesis. Archives of physical medicine and rehabilitation. 1992;73(9):794–7.
9. van der Gaag SM, Frankema SP, van der Ploeg ES, Baart SJ, Huygen FJ. Evaluating community-based intrathecal baclofen therapy: effectiveness, safety, and feasibility. Journal of Clinical Medicine. 2024 Mar 22;13(7):1840.
10. Skogberg O, Samuelsson K, Ertzgaard P, Levi R. Changes in body composition after spasticity treatment with intrathecal baclofen. Journal of Rehabilitation Medicine. 2017;49(1):36–9.
11. -Mathur SN, Chu SK, McCormick Z, Chien GCC, Marciniak CM. Long-term intrathecal baclofen: outcomes after more than 10 years of treatment. PM&R. 2014;6(6):506–13. e1.
12. Kaye AD, Cheon SY, Roque MH, Gibbs C, Mott KR, Wandler AM, et al. Efficacy, Indications, and Safety of Intrathecal Baclofen Pump: A Narrative Review. Current Pain and Headache Reports. 2025;29(1):1–10.
13. Masrour M, Zare A, Presedo A, Nabian MH. Intrathecal baclofen efficacy for managing motor function and spasticity severity in patients with cerebral palsy: a systematic review and meta-analysis. BMC neurology. 2024;24(1):143.
14. Otero-Luis I, Saz-Lara A, Cavero-Redondo I, Pascual-Morena C, Martínez-García I, de Arenas-Arroyo SN. Effectiveness of the intrathecal baclofen pump in the treatment of spasticity of different aetiologies: A systematic review and meta-analysis. Neurología. 2025.
15. Motta F, Antonello CE, Stignani C. Intrathecal baclofen and motor function in cerebral palsy. Developmental Medicine & Child Neurology. 2011;53(5):443–8.
16. Tiefenbach J, Machado AG, Bethoux F. Uncovering the rate and risk factors of intrathecal baclofen pump–associated complications in the adult population. Neurosurgical Focus. 2024;56(6):E12.
17. Saulino M. The use of intrathecal baclofen in pain management. Pain Management. 2012;2(6):603–608. doi:10.2217/pmt.12.60.