1
PAIN MANAGEMENT IN OBSTETRIC ANAESTHESIA & POST-CAESAREAN PHYSIOTHERAPY

Abstract: Caesarean delivery is one of the most commonly performed surgical procedures globally, and effective postoperative pain management is essential for promoting early maternal recovery, facilitation of breastfeeding, enhanced maternal–neonatal bonding, and reducing the risk of persistent post-surgical pain. Obstetric anaesthesia plays a pivotal role through multimodal analgesia strategies that include neuraxial techniques, long-acting opioids, peripheral nerve blocks, non-opioid systemic agents, and enhanced recovery protocols.

Post-caesarean physiotherapy represents the second critical component of recovery, contributing to pain reduction, improved respiratory mechanics, early mobilization, prevention of thromboembolic complications, strengthening of pelvic floor muscles, and accelerating return to normal functional status. This review integrates current evidence on the combined use ofanaesthesia strategies with early physiotherapy interventions to optimize maternal outcomes after caesarean delivery. It highlightsEvidence-based practices, breastfeedingsafety considerations, appropriate timing of rehabilitation, impact on maternal satisfaction, and long-term benefits. A coordinated multidisciplinary approach involving

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25 anaesthesiologists, obstetricians, physiotherapists and nursingteams is
26 emphasized as fundamental to modern obstetric perioperative care.

27 **Keywords:**Caesarean section, Maternal recovery, Multimodal
28 analgesia,Obstetric anaesthesia, Post caesarean physiotherapy,
29 Postoperative pain, Pain management, Regional anaesthesia.

30 **Introduction**

31 Pain management is a fundamental component of obstetric care, with
32 significant implications for maternal comfort, clinical outcomes, and
33 overall childbirth experience. Obstetric anaesthesia encompasses
34 various techniques aimed at providing effective analgesia during
35 labour, vaginal delivery, and surgical interventions such as caesarean
36 section.caesarean delivery represents a major abdominal surgery
37 associated with moderate to severe postoperative pain, inadequate
38 pain management, can delay recovery and increase the risk of
39 postoperative complications.[1,2,3]Effective pain management in
40 obstetric anaesthesia is vital not only for alleviating physical pain but
41 also for minimizing stress responses, enhancing maternal cooperation,
42 and promoting early bonding between mother and infant.[4]Neuraxial
43 anaesthetic techniques such as spinal, epidural, and combined spinal–
44 epidural anaesthesia are widely used due to their efficacy and safety
45 profile.[5,6,7] Additionally, the use ofmultimodal analgesiacombining
46 opioids, non-opioid analgesics, and regional nerve blocks-has
47 significantly enhanced postoperative pain control while decreasing the
48 incidence of opioid-related side effects.[8,9]Despite significantadvances
49 in anaesthetic practices, postoperative pain after caesarean section

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50 remains a clinical challenge and can negatively affect early
51 mobilization, breastfeeding, and respiratory function.[10,11]This
52 highlights the crucial role of post-caesarean physiotherapy as a key
53 element of postpartum care.Physiotherapy interventions aim to reduce
54 pain, prevent pulmonary and thromboembolic complications,
55 restoration of mobility, and strengthen core and pelvic floor
56 muscles.[12,13,14] Earlyinvolvement of physiotherapy has been shown to
57 accelerate functional recovery, promote independence, and enhance
58 overall quality of life during the postpartum period.[15]

59 A coordinated approach that integrates effective obstetric anaesthesia
60 with structured post-caesarean physiotherapy provides a
61 comprehensive framework for pain control and maternal
62 rehabilitation. Recognizing the interaction between anaesthetic pain
63 management and physiotherapeutic recovery is essential for
64 healthcare professionals involved in maternal care.[16]This review aims
65 to provide a comprehensive overview of pain management strategies
66 in obstetric anaesthesia and to highlights the role of post-caesarean
67 physiotherapy in supporting safe, efficient and effective postpartum
68 recovery.[17]

69 **Materials and Methods:** The data for this review were compiled
70 from a wide range of articles published which sourced from multiple
71 academic journals. These papers were carefully selected and reviewed
72 to extract relevant information applicable to the focus of this study.

73 1.Principles of Pain in Obstetric Anaesthesia

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1.1 Physiological Considerations

Pregnancy induces significant changes in cardiovascular, respiratory, and gastrointestinal changes that impact on anaesthetic management and pain perception.

- **Increased blood volume and cardiac output.**
- **reduced functional residual capacity.**
- **changes in pain sensitivity influenced by hormonal and psychologicalfactors.**[18,19,20]

such physiological changesrequire analgesic techniques to be tailored and closely monitored to maintain both maternal and fetal safety.[1]

2. Pain Management in Obstetric Care

2.1. Nature of Obstetric Pain

Labour pain arises from multiple mechanisms, including uterine contractions, cervical dilatation, stretching of pelvic tissues, and pressure on pelvic nerves.[4]During the first stage of labour, pain is primarily visceral in nature and transmitted through the T10–L1 spinal segments. In the second stage, pain becomes predominantly somatic and is conveyed via the pudendal nerve (S2–S4).[21]

The intensity and perception of labour pain are further influenced by factors such as parity, fear and anxiety, duration of labour, psychosocial elements, and cultural expectations.[22]

2.2Pharmacological Pain Relief During Labour

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96 A variety of pharmacological methods are used to relieve labour pain,
97 including systemic opioids, inhalational agents, and regional
98 anaesthetic techniques such as epidural and combined spinal–epidural
99 analgesia, as well as pudendal nerve blocks. Among these, epidural
100 analgesia is widely regarded as the gold standard because of its
101 superior pain relief and high levels ofmaternal satisfaction, although
102 it may be associated with adverse effects such as hypotension and
103 motor blockade.[5,6,23]

104 **Table 1: Pharmacological Pain Relief During Labour**

Method	Drugs / Technique	Effectiveness	Advantages	Disadvantages / Risks
Systemic Analgesics (Opioids)	Pethidine, Fentanyl, Remifentanil	Moderate pain relief	Easy to administer	Maternal sedation, nausea, vomiting, neonatal respiratory depression
Inhalational Analgesia	Entonox (50% N_2O + 50% O_2)	Mild–moderate relief	Safe, rapid onset, self-administered	Limited analgesic efficacy
Regional Analgesia – Epidural	Local anaesthetic + opioid (e.g., bupivacaine + fentanyl)	Excellent pain relief	Gold standard, high maternal satisfaction, reduced catecholamine surge	Hypotension, motor block, rare post-dural puncture headache

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Combined Spinal–Epidural (CSE)	Single spinal dose + epidural catheter	Rapid onset with prolonged effect	Flexibility, effective analgesia	Similar risks to epidural
Pudendal Nerve Block	Local anaesthetic injection	Effective for second stage	Useful for perineal analgesia	Limited duration and coverage

2.3 Anaesthetic Considerations in Caesarean Section

Neuraxial anaesthesiaespecially spinal anaesthesiais most commonly preferred technique for elective and emergency caesarean sectionsdue to its rapid onset, reliable, dense sensory block, and favourable safety profile. Epidural anaesthesia can be continued or extended from labour analgesia, while general anaesthesia is typically reserved for specific indications such asemergencies or contraindications to neuraxial techniques.[24,25,26]

Table 2: Anaesthetic Considerations in Caesarean Section

Technique	**Indications**	**Advantages**	**Concerns/Risks**
Spinal Anaesthesia	Most elective and emergency C-sections	Fast onset, dense sensory block, low complication rate	Hypotension, limited duration
Epidural Anaesthesia	Women with existing labour epidural	Avoids GA, controlled dosing	Slower onset, patchy block

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General Anaesthesia	Category-1 emergencies, failed neuraxial block, contraindications	Rapid induction	Difficult airway, aspiration risk, maternal awareness, neonatal depression

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116 ## 2.4 Post-Caesarean Pain Management

117 Post caesarean pain is typically peaks within the first 24–48 hours
118 following caesarean delivery. Inadequate pain control can delay
119 mobilization, prolong hospital stay, and adversely impact
120 breastfeeding as well as overall maternal recovery.[27] therefore a
121 Multimodal approach to analgesia is recommended, combining
122 medications such as paracetamol, NSAIDs, with regional anaesthesia
123 techniques, and limited opioid use is recommended to optimize pain
124 relief to reduce adverse effects.[28]Analgesic safety during
125 breastfeeding is a critical consideration, with paracetamol and
126 ibuprofen considered safe, whereas codeine and tramadol are
127 discouraged due to risks of neonatal sedation.[29]

128 **Table 3: Post-Caesarean Pain Management – Goals and**
129 **Challenges**

Aspect	**Details**
Peak Pain Period	First 24–48 hours post-surgery
Primary Goals	Adequate analgesia, early mobilization, complication prevention

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Functional Outcomes	Breastfeeding facilitation, enhanced recovery
Risksof Inadequate Control	Delayed mobility, prolonged hospital stay

130 **Table 4: Multimodal Analgesia After Caesarean Section**

Category	**Methods**	**Purpose**
Pharmacological	Paracetamol, NSAIDs, minimal opioids	Reduce pain, limit opioid side effects
Regional Techniques	TAP block, ilioinguinal–iliohypogastric block	Incisional pain relief
Local Anaesthesia	Wound infiltration	Reduced postoperative pain
Epidural Analgesia	If catheter present	Continuous analgesia

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132 **Table 5: Analgesics and Safety During Breastfeeding**

Medication	**Safety Profile**
Paracetamol	Safe
Ibuprofen	Safe
Codeine	Avoid if possible
Tramadol	Avoid due to neonatal sedation risk

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134 ## 3. Role of post caesarean physiotherapy

135 Post-caesarean physiotherapy constitutes an essential element of
136 comprehensive pain management after caesarean delivery. Although

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obstetric anaesthesia provides effective pain relief during surgery and in the immediate postoperative period, physiotherapy addresses the broader functional, musculoskeletal, respiratory, and psychological aspects of maternal recovery. Early, well-structured physiotherapy interventions work synergistically with pharmacological analgesia to reduce pain perception, minimize postoperative complications, and support a safe and timely return to everyday activities.[13,15,30]By promoting early mobility, enhancing circulation, improving respiratory mechanics, and facilitating neuromuscular re-education,physiotherapy strengthens the overall effectiveness of multimodal analgesia. In this way, it serves a pivotal role in converting pain relief into meaningful functional recovery and improved maternal well-being.[31]

4. Goals and Protocols of Post-Caesarean Physiotherapy

The goals of post-caesarean physiotherapy include pain reduction, early mobilization, prevention of postoperative complications, restoration of functional independence, pelvic floor and core rehabilitation, and psychological well-being.[17]Early physiotherapy interventions such as breathing exercises, supported coughing, positioning, and assisted ambulation reduce pulmonary complications and thromboembolic risk. Progressive rehabilitation phases focus on core strengthening, scar mobilization, pelvic floor training, and long-term musculoskeletal health.[32,33,34]

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4.1 The primary goals of post-caesarean physiotherapy are multidimensional and patient-centered

1. **Pain Reduction**
    - Minimize postoperative pain and discomfort
    - Reduce reliance on opioid analgesics
2. **Early Mobilization**
    - Facilitate safe ambulation
    - Prevent venous stasis and thromboembolic events
3. **Prevention of Postoperative Complications**
    - Reduce respiratory complications such as atelectasis
    - Prevent musculoskeletal stiffness and deconditioning
4. **Restoration of Functional Independence**
    - Enable self-care and newborn handling
    - Promote confidence in movement
5. **Pelvic Floor and Core Rehabilitation**
    - Restore pelvic floor strength
    - Improve abdominal muscle function and postural stability
6. **Psychological Well-being**
    - Reduce anxiety related to pain and movement
    - Enhance maternal confidence and satisfaction.[17]

4.2 Post-Caesarean Physiotherapy Protocols

1. Immediate Postoperative Phase (0–24 Hours)

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183 **Interventions:**

184 - Deep breathing exercises and incentive spirometry
185 - Supported coughing techniques
186 - Positioning and log-rolling for bed mobility
187 - Gentle limb movements
188 - Early assisted ambulation (as medically permitted)

189 **Benefits:**Improves lung expansion,Prevents atelectasis and DVT,
190 Reduces pain during movement

191 **2. Early Recovery Phase (Day 2–7)**

192 **Interventions:**

193 - Progressive ambulation
194 - Postural correction exercises
195 - Pelvic tilts and gentle trunk mobility
196 - Lower limb circulation exercises
197 - Gentle activation of transversus abdominis

198 **Benefits:**Improves circulation and mobility, Enhancescore stability,
199 Reduces incisional and back pain

200 **3. Scar and Abdominal Rehabilitation Phase**

201 **Interventions:**

202 - Education on wound care and posture

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- Scar desensitization and mobilization (after wound healing)
- Myofascial release techniques

Benefits: Prevents adhesions, Improves scar mobility, Reduces chronic pain

4. Pelvic Floor Rehabilitation

Interventions:

- Pelvic floor muscle training (Kegel exercises)
- Biofeedback and neuromuscular re-education (if required)

Benefits: Improves continence, Supports pelvic organs, Reduces pelvic and low back pain

5. Long-Term Rehabilitation Phase

Interventions:

- Progressive core strengthening
- Back care and ergonomic training
- Gradual return-to-activity programs
- Education on safe lifting and infant care
- Psychological reassurance

Benefits: Prevents chronic musculoskeletal pain, Improves quality of life, Enhances long-term maternal health

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222 **Table 6: Physiotherapy After Caesarean Delivery Phases**
223 **and Interventions**

224 **Early Phase (0–24 Hours)**

Intervention	Purpose
Deep breathing & incentive spirometry	Prevent atelectasis
Supported coughing	Airway clearance
Positioning & log rolling	Pain reduction
Early ambulation	Prevent DVT

225

226 **Intermediate Phase (Day 2–7)**

Exercise	Benefit
Gentle mobility	Improve circulation
Posture correction	Prevent back pain
Pelvic tilts	Core activation
Lower limb exercises	DVT prevention
Transversus abdominis activation	Abdominal support

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228 **Table 7: Scar, Abdominal & Pelvic Floor Rehabilitation**

Component	Intervention	Outcome
Scar care	Education, desensitisation	Prevent adhesions
Pelvic floor training	Kegels, biofeedback	Improved continence
Pelvic support	Strengthening exercises	Reduced pelvic pain

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230 **Table 8: Long-Term Post-Caesarean Rehabilitation**

Focus Area	Strategies
Core strengthening	Progressive exercises
Back care	Postural correction
Functional recovery	Gradual return to activities
Ergonomics	Safe childcare techniques
Psychological care	Reassurance and education

231

232 ## 5. Enhanced Recovery After Caesarean Section (ERACS)

233 ERACS protocols integrate multimodal analgesia, early feeding, early
234 mobilization, and physiotherapy to improve pain control, reduce
235 opioid use, shorten hospital stay, and enhance maternal satisfaction.[16]

236 **Table 9: Enhanced Recovery After Caesarean Section**
237 **(ERACS)**

Component	Description
Patient counselling	Pre- and post-operative education
Multimodal analgesia	Reduced opioid use
Early feeding	Faster recovery
Early mobilisation	Reduced complications
Physiotherapy integration	Functional independence

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239 ### Benefits of ERACS

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Outcome	Impact
Pain control	Improved
Hospital stay	Reduced
Maternal satisfaction	Increased

240

241 **Table 10: Complications of Poor Pain Management**

System Affected	Complication
Mobility	Delayed ambulation
Vascular	Deep vein thrombosis
Respiratory	Atelectasis
Surgical site	Wound complications
Pain	Persistent postoperative pain
Mental health	Postpartum depression
Maternal–infant bond	Impaired bonding, breastfeeding difficulty

242 ## 6.Advantages of Post-Caesarean Physiotherapy

243 - Reduces postoperative pain intensity.
244 - Decreases opioid consumption.
245 - Accelerates functional recovery.
246 - Prevents respiratory and thromboembolic complications.
247 - Improves posture and core stability.
248 - Enhances breastfeeding comfort.
249 - Improves maternal satisfaction and confidence.

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- Supports early discharge and cost-effective care.

Challenges in Post-Caesarean Physiotherapy

- Inadequate awareness among patients and healthcare providers.
- Limited access to trained physiotherapists.
- Fear of pain and movement among mothers.
- Cultural misconceptions regarding postpartum rest.
- Time constraints in hospital settings.
- Variability in pain tolerance and motivation.

Pain and Discomfort

- Incisional pain, abdominal tenderness, and back pain limit ability to perform exercises.
- Fear of pain causes reluctance to mobilize.
- Pain increases with coughing, laughing, or movement.

Delayed Mobilization

- Anxiety, cultural beliefs, or lack of awareness delay early movement.
- Prolonged bed rest increases risk of DVT, muscle weakness, and respiratory issues.

Fatigue and Physical Weakness

- Blood loss during surgery and anaemia.
- Sleep deprivation and exhaustion from childbirth.

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271 • Reduced endurance limits exercise participation.

272 **Psychological and Emotional Barriers**

273 • Postpartum depression or anxiety
274 • Fear of wound rupture or injury
275 • Low motivation or lack of confidence

276 **Wound and Surgical Limitations**

277 • Pain near incision
278 • Wound infection or delayed healing
279 • Risk of dehiscence (rare but feared)

280 **Respiratory Restrictions**

281 • Shallow breathing due to pain
282 • Ineffective coughing
283 • Risk of atelectasis and chest infections if breathing exercises are
284 neglected

285 **Pelvic Floor and Core Muscle Weakness**

286 • Weak pelvic floor post-pregnancy
287 • Abdominal muscle separation (diastasis recti)
288 • Difficulty engaging core muscles correctly

289 **Lactation and Breastfeeding Posture Challenges**

290 • Poor posture while breastfeeding causes neck, shoulder, and
291 back pain
292 • Difficulty performing exercises while nursing frequently

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293 8.**Outcomes and Benefits of Integrated Pain Management**

294 When post-caesarean physiotherapy is integrated with effective
295 obstetric anaesthesia:

296 - Lower pain scores
297 - Enhanced gastrointestinal and bladder function
298 - Improved mobility and independence
299 - Superior pain relief and reduced analgesic dependence
300 - Reduced postoperative complications
301 - Increased patient satisfaction
302 - Shorter hospital stay
303 - Improved psychological and emotional well-being
304 - Better mother–infant bonding
305 - Better pelvic floor and core muscle recovery
306 - Improved breastfeeding success
307 - Improved respiratory outcomes
308 - Enhanced wound healing and circulation
309 - Faster functional recovery and mobilization
310 - Reduced incidence of chronic postoperative pain

311 9.Future Directions

312 Enhanced Recovery After Caesarean Section (ERACS)

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313 • Standardized physiotherapy-inclusive pathways

314 **Individualized Rehabilitation Programs**

315 • Tailored based on pain levels, comorbidities, and functional
316 status

317 **Personalized and Precision Pain Medicine**

318 • Development of individualized analgesic plans based on
319 genetics, pain sensitivity, psychological profile, comorbidities,
320 and breastfeeding considerations.
321 • Use of pain prediction models to identify women at high risk of
322 severe postoperative pain or chronic post-surgical pain.

323 **Enhanced Multimodal Analgesia Strategies**

324 • Greater focus on opioid-sparing or opioid-free anesthesia
325 using combinations of paracetamol, NSAIDs, regional
326 blocks, dexmedetomidine, and ketamine microdosing.
327 • Wider adoption of Enhanced Recovery After Cesarean (ERAC)
328 protocols globally.

329 **Interdisciplinary Collaboration**

330 • Stronger coordination between anaesthesiologists, obstetricians,
331 and physiotherapists

332 **Research and Evidence-Based Practice**

333 • Long-term outcome studies

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334 - Development of standardized clinical guidelines

335 **Advancement in Regional Anaesthesia Techniques**

336 - Expanded use of ultrasound-guided fascial plane blocks, such
337 as:
338 - Transversus Abdominis Plane (TAP) block
339 - Quadratus Lumborum (QL) block
340 - Erector Spinae Plane (ESP) block
341 - Longer-acting local anaesthetics and liposomal formulations for
342 prolonged analgesia.
343 - Improved safety and standardization protocols.

344 **Integration of Technology and Digital Health**

345 - Mobile apps and tele-rehabilitation platforms to guide post-
346 caesarean physiotherapy at home.
347 - Wearable sensors to monitor mobility, pain levels, wound stress,
348 and physical progress.
349 - AI-driven digital coaching for exercise adherence and pain
350 monitoring.

351 **Stronger Focus on Non-Pharmacological Pain Modulation**

352 - Increasing emphasis on physiotherapy as a therapeutic pain
353 management tool, not only supportive care.
354 - Use of: Relaxation therapy, Breathing techniques, Biofeedback,
355 Transcutaneous Electrical Nerve Stimulation (TENS)

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356 - Integration of mind–body interventions such as guided imagery
357 and mindfulness-based cognitive pain therapy.

358 **Early Rehabilitation and Structured Physiotherapy Pathways**

359 - Standardizing post-caesarean physiotherapy protocols
360 internationally.
361 - Incorporation of physiotherapists as routine members of
362 obstetric anaesthesia care teams.
363 - Development of ERAS + Physiotherapy hybrid models.

364 **Prevention of Chronic Post-Surgical Pain (CPSP)**

365 - Early identification of risk factors such as severe acute pain,
366 anxiety, pre-existing chronic pain, and surgical trauma.
367 - Preventive strategies: regional blocks, neuro-modulatory
368 techniques, structured physiotherapy
369 - Research into neuroimmune mechanisms of persistent post-
370 caesarean pain.

371 **Breastfeeding-Safe Pain Protocols**

372 - Continued development of analgesic strategies safe for lactating
373 mothers.
374 - Clearer global guidelines to avoid codeine/tramadol risks and
375 encourage safer alternatives.

376 **Long term outcome research and AI assisted clinical decision**
377 **tools.**[10,35]

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Conclusion: Pain management in obstetric anaesthesia and post-caesarean physiotherapy represents a paradigm shift from isolated symptom control to integrated, patient-centered perioperative care. While advances in neuraxial anaesthesia, multimodal analgesia, and regional blocks have significantly improved intraoperative and immediate postoperative pain control, optimal recovery cannot be achieved without addressing functional rehabilitation. Post-caesarean physiotherapy serves as the critical bridge between analgesia and functional independence, ensuring that pain relief translates into mobility, confidence, and quality of life.From an advanced healthcare perspective, the future of obstetric pain management lies in precision-based, data-driven, and multidisciplinary care models. Integration of enhanced recovery pathways, early physiotherapy, and emerging digital health tools—including AI-assisted risk stratification, personalized rehabilitation planning, and remote monitoring—has the potential to further optimize maternal outcomes. By reducing opioid reliance, preventing long-term morbidity, and supporting maternal mental health and bonding, this integrated approach aligns with global goals of safe motherhood and value-based care.In conclusion, a

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400 collaborative model involving anaesthesiologists,
401 obstetricians, physiotherapists, nurses, and emerging digital
402 health systems represents the gold standard for modern
403 obstetric perioperative management. Such a holistic strategy
404 not only improves short-term recovery but also safeguards
405 long-term maternal health, reinforcing the essential role of
406 post-caesarean physiotherapy within comprehensive pain
407 management frameworks.

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