



LECTURE 1: Why Colonoscopy Hurts — and How to Prevent It

Participant Handout

Colonoscopy Without Pain | MEA Physician Symposium
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Speaker: Dr. Samer Al-Dury

LEARNING OBJECTIVES

By the end of this lecture, you will understand:

1. The anatomy and physiology of colonoscopy-related pain
2. The primary mechanisms causing discomfort (mechanical vs. insufflation-related)
3. Evidence-based prevention strategies you can implement immediately
4. The role of technique, technology, and team communication
5. How to build patient confidence in painless colonoscopy

THE PAIN PARADOX: Why This Matters

Colonoscopy is the gold standard for diagnosis and treatment of colorectal disease. Yet patient perception of pain remains a major barrier to screening completion and patient acceptance.

Key Facts:

- Up to 64.5% of unsedated patients report experiencing some discomfort
- 14.2% specifically report pain (BMJ study, 2024)
- Pain is NOT inevitable — it results from technique, insufflation method, and anatomy
- Pain-free colonoscopy IS achievable with proper technique and technology

Clinical Significance:

Pain during colonoscopy reduces:

- Screening compliance and completion rates
- Polyp detection rates
- Patient satisfaction
- Willingness to return for future procedures

TWO FUNDAMENTAL PAIN MECHANISMS

MECHANISM 1: MECHANICAL STRETCHING

What Happens:

The endoscope insertion creates longitudinal and transverse deformation of the colon. The colon wall is pulled and stretched, especially at angulated segments.

Why It Hurts:

- Peritoneal folds (ligaments) suspended from flexures are highly pain-sensitive
- Mesenteric traction amplifies the stretching sensation
- The colon has no ability to shorten more than approximately 20 cm, so further stretch causes pain

Where Pain Occurs Most:

- Sigmoid colon — sharp angles, high resistance, significant ligament stretching
- Hepatic and splenic flexures — extreme angulation and high tension
- Post-surgical colons — adhesions increase mesenteric traction significantly

Clinical Pearl:



Mechanical stretching pain is preventable with proper technique. Operators who minimize loop formation cause significantly less pain.

MECHANISM 2: INSUFFLATION-INDUCED DISTENSION

What Happens:

Intraluminal distension from air or CO₂ insufflation triggers:

- High-amplitude propagated peristaltic contractions
- Visceral distension that activates pain receptors
- Post-procedure bloating and continued discomfort

Why Air is Problematic:

- Air is poorly absorbed from the bowel — creates persistent luminal pressure
- Air distension amplifies mesenteric traction on ligaments
- Postoperative pain lasts significantly longer — patients complain for hours or days

Why CO₂ is Superior:

- CO₂ is rapidly absorbed from bowel tissue
- Reduces luminal distension substantially
- Significantly reduces post-procedure bloating
- No systemic risk — absorption is safe even with high insufflation

Clinical Pearl:

Switching from air to CO₂ alone reduces pain by 30-40% without any change in technique.

FOUR DEFORMATION PATTERNS: Understanding What You're Doing

During colonoscope insertion, four distinct deformation patterns occur:

1. STRAIGHT-TUBE DEFORMATION

- Scope advances without looping
- Minimal pain if technique is gentle
- Achieved through: thin scope, water guidance, minimal push force
- Ideal goal: This is what we're aiming for

2. LOOP FORMATION (ALPHA LOOP) — MOST COMMON PROBLEM

- Scope bends in sigmoid colon creating an "N" or reverse "N" shape
- Loop must be straightened via push-twirl maneuver
- Most painful deformation — requires strong pushing forces
- Increased mesenteric stretching with each push
- How to recognize: Vision appears fixed, difficulty advancing, patient reports discomfort

3. ACCORDION FORMATION — SEVERE PROBLEM

- Colon folds back on itself like compressed springs
- Occurs with excessive push force on bent scope
- Extremely painful — highest ligament tension
- Must be recognized early and corrected immediately
- How to recognize: Scope advancement halts, accordion-like appearance on monitor, severe pain

4. SPLINTING/STRAIGHTENING — THERAPEUTIC TECHNIQUE

- Deliberate straightening technique to extend mesentery
- Reduces tension on ligaments and reduces pain
- Counterintuitive but highly effective
- How to perform: Pull back slightly while twisting, allowing colon to straighten



Key Insight:

Operators who understand these deformations and prioritize deformation avoidance have significantly lower pain scores. Prevention is better than Correction.

EVIDENCE-BASED PAIN REDUCTION STRATEGIES

MOST EFFECTIVE: NON-PHARMACOLOGICAL INTERVENTIONS

1. CO2 INSUFFLATION (STRONGEST EVIDENCE)

Pain Reduction: 30-40% compared to air insufflation

Mechanisms:

- CO2 is rapidly absorbed from bowel, reducing luminal distension
- Minimizes postprocedural bloating
- Reduces mesenteric traction amplification

Clinical Evidence:

- Meta-analysis of 23 randomized controlled trials confirms benefit
- 2024 finding: CO2 reduced hospital admissions after large polypectomy by lowering postprocedural pain
- Works in all patient populations
- No contraindications

Recommendation:

- Should be standard in all endoscopy units
- Cost: Minimal (equipment approximately \$2,000-5,000 initial investment)
- Requires training for staff (minimal)

2. WATER-ASSISTED TECHNIQUES

Pain Reduction: 25-35% compared to air insufflation

Two Approaches:

- Water Exchange (WE): Remove water during insertion phase
- Water Immersion (WI): Remove water during withdrawal phase

Mechanisms:

- Minimizes luminal distension (water doesn't distend like air)
- Easier scope advancement (less resistance, fewer loops needed)
- Reduced mesenteric traction
- May improve polyp visibility during insertion

Clinical Evidence:

- Prospective RCTs from US/Europe show improved adenoma detection AND reduced pain
- Particularly effective for inexperienced operators
- Suitable when CO2 unavailable

Recommendation:

- Excellent alternative if CO2 not available
- Combined with CO2 for maximum benefit

3. GENTLE INSERTION TECHNIQUE

Pain Reduction: 60-65% reduction in pain scores (expert vs. poor technique)



Key Techniques:

- Minimize push force — watch for deformation patterns on scope guide
- Use torque, not push — twist to navigate, don't force advancement
- Strategic position changes — left lateral, supine, right lateral, prone
- Splinting maneuver at sigmoid — pull back while twisting to straighten colon
- Avoid loops — prevention far better than correction
- Shortest insertion path — use Z-maneuvers to navigate difficult anatomy

Evidence:

- Expert endoscopists cause 65% less pain than poor technique operators (OR 0.35)
- Skill matters more than any single technology
- Learning curve: approximately 200 procedures to optimize with deliberate practice

Recommendation:

- Primary focus of training and simulator practice
- Continuous skill development throughout career
- Regular feedback on pain scores and technique

4. VARIABLE-STIFFNESS COLONOSCOPE

Pain Reduction: 20-25% compared to standard rigid scope

Benefits:

- Prevents excessive bending and mechanical stretching
- Works for both experienced AND inexperienced operators
- High cecal intubation rate plus reduced sedation need
- Adjustable stiffness prevents over-bending and reduces tension

Recommendation:

- Excellent addition to technique arsenal
- Particularly helpful for learning endoscopists
- Device dependent — availability varies

MODERATE EVIDENCE: PHARMACOLOGICAL INTERVENTIONS

5. MEPERIDINE (PETHIDINE) PLUS MIDAZOLAM

Effectiveness: 30-40% reduction in pain perception

Dosing:

- Mild sedation: Midazolam 1-2 mg IV
- Moderate sedation: Midazolam 1-3 mg plus Fentanyl 50-100 micrograms IV
- Alternative: Meperidine 12.5-25 mg IV

Safety Profile: Comparable to propofol in most settings

6. PROPOFOL (WITH ANESTHESIA SUPPORT)

Effectiveness: Highest patient satisfaction and pain reduction

Indication: Deep sedation when required

- Requires trained anesthesia support
- Not always available in all settings
- Excellent for high-anxiety patients



PATIENT RISK FACTORS: Who Is At Higher Risk?

NON-MODIFIABLE RISK FACTORS

Factor	Risk Increase	Clinical Significance
Female gender	2.3x higher	Requires extra communication and sedation planning
Age less than 50 years	Increased	Younger patients may need more sedation
Obesity (BMI greater than 30)	Increased	Difficult anatomy requires extra skill
Previous abdominal surgery	Adhesions	High risk for severe pain
Diverticular disease	Increased	More difficult insertion

MODIFIABLE RISK FACTORS (YOU CAN CONTROL THESE!)

Poor Bowel Preparation

- Risk Increase: OR 1.5 for pain
- Mechanism: Dirty colon requires more loops, more force
- Solution: Proper prep discussion, adequate purgation, Boston Prep Scale 8 or greater
- Clinical Pearl: 60% of pain prevention happens BEFORE the procedure

Operator Inexperience

- Risk Increase: OR 2.9 for pain
- Mechanism: Poor technique leads to looping, excessive force
- Solution: Training, deliberate practice, feedback on pain scores
- Evidence: Skill matters more than any technology

Inadequate Sedation

- Risk Increase: Variable, but significant
- Mechanism: Anxiety amplifies pain perception
- Solution: Appropriate sedation strategy tailored to patient and anatomy

Interesting Clinical Findings

- Previous malignancy history associated with LESS pain (psychological resilience?)
- Counterintuitively, previous abdominal surgery alone didn't increase pain in some studies
- Key Takeaway: Operator skill and technique matter MORE than patient anatomy

PRACTICAL PAIN PREVENTION: Your Action Plan

BEFORE THE PROCEDURE: PREPARATION PHASE (60% OF PAIN PREVENTION)

Bowel Preparation

- Ensure adequate purgation using Boston Bowel Preparation Scale
- Target: Scale 8 or greater in all segments
- Better prep equals fewer loops equals significantly less pain
- Discuss preparation importance with patient

Patient Communication Example:

"The quality of your bowel preparation directly affects your comfort during the procedure. Please follow our instructions exactly."

Patient Communication and Expectation-Setting

- Set expectation: "This procedure is well-tolerated. Most patients experience minimal discomfort."
- Build confidence in painless colonoscopy
- Explain what to expect: position changes (left to supine to right lateral)
- Address specific fears or previous bad experiences

Key Message:

"We use modern techniques and gentle handling to make this comfortable. Please tell us if you feel pain so we can adjust our approach."



Sedation Strategy

Determine appropriate level for each patient:

- No sedation: Use CO₂ plus water exchange (can be truly comfortable)
- Mild sedation: Midazolam 1-2 mg IV (anxiolysis)
- Moderate sedation: Midazolam 1-3 mg plus Fentanyl 50-100 micrograms IV
- Deep sedation: Propofol with anesthesia support

DURING THE PROCEDURE: TECHNIQUE PHASE

Insufflation Method — MOST IMPORTANT SINGLE CHANGE

- USE CO₂, NOT AIR — Single biggest technical improvement for pain reduction
- If CO₂ unavailable: Use water exchange technique
- Air only as last resort

Scope Selection

- Use variable-stiffness colonoscope if available
- Start flexible, adjust stiffness as needed based on resistance
- Ultrathin scope for difficult cases (less mechanical stretching)

Insertion Technique: The Gold Standard (8-Step Protocol)

1. Gentle advancement — Minimize push force; let scope advance with minimal resistance
2. Recognize deformation patterns — Know what's happening at each moment
3. Avoid loops — Prevention is far better than correction
4. Use torque, not push — Twist to advance; don't force through resistance
5. Position changes — Left lateral, supine, right lateral, prone as needed
6. Splinting maneuver — Pull back slightly while twisting to straighten colon
7. Targeted abdominal pressure — Brief pressure, not continuous; patient communicates
8. Stop when pain evident — Rest, reassess, use different technique

Team Communication (Essential!)

- Constantly coordinate with nursing team
- Nursing role: Abdominal palpation, pressure application, patient reassurance, pain assessment
- Communication frequency: "How's the pain?" every 10-20 seconds during difficult segments
- Key agreement: "Stop immediately if severe pain — reassess technique"
- Patient engagement: Involve patient in position changes; explain what you're doing

THE THREE-PILLAR APPROACH: PROVEN PROTOCOL

PILLAR 1: OPTIMIZE INSUFFLATION

- Switch from air to CO₂ immediately
- Result: 30-40% pain reduction (single intervention)
- Cost: Minimal (approximately \$2,000-5,000 equipment)
- Implementation: Should be standard in all programs

PILLAR 2: MASTER GENTLE TECHNIQUE

- Minimize loop formation through:
 - Reduced push force (watch scope guide)
 - Increased torque control (twist to navigate)
 - Splinting maneuver at sigmoid
- Learning curve: approximately 200 procedures with deliberate practice
- Outcome: 65% pain reduction vs. poor technique
- Practice: Simulator blocks today will build these skills

PILLAR 3: STRATEGIC SEDATION

- Tailor to patient and operator experience



- Mild sedation for most (anxiolysis plus analgesia)
- Moderate sedation for difficult cases
- Deep sedation only when fully supported
- Result: Patient satisfaction greater than 95%

Combined Effect

- CO2: 40% reduction
- Technique: 65% reduction
- Sedation: 30% reduction
- Total outcome: "Near-painless" colonoscopy for vast majority

PATIENT COMMUNICATION SCRIPT: BUILDING CONFIDENCE

WHAT TO SAY BEFORE THE PROCEDURE

"Good morning! Today we'll do a colonoscopy to check your colon health. I want to reassure you about several important things:

First, this procedure is very well-tolerated. Most patients experience minimal to no discomfort. We use several modern techniques to make this as comfortable as possible.

Second, we're using CO2 insufflation instead of air. This means you won't feel bloated after the procedure, and you'll be much more comfortable during it.

Third, I'll be very gentle. My technique minimizes stretching and discomfort. We'll use different body positions and patient movement to make the scope's path easier for both of us.

Fourth, we have excellent sedation options. If you want to sleep through it, we can do that safely. If you prefer to stay awake and watch the screen, that's fine too — and it's still comfortable.

Finally, tell us immediately if you feel pain. Don't tough it out. We'll adjust our technique or give you more medication. Your comfort is our priority."

Expected Outcome

- Patient confidence increases
- Anxiety decreases
- Cooperation increases
- Pain perception decreases

KEY TAKEAWAYS: WHAT YOU MUST REMEMBER

THE SCIENCE

- Colonoscopy pain has TWO sources: mechanical stretching plus insufflation distension
- Both are modifiable with technique and technology
- Pain is NOT inevitable — it's a quality indicator

THE SOLUTIONS (IN ORDER OF EFFECTIVENESS)

- CO2 insufflation — single biggest technical improvement (30-40% reduction)
- Water exchange — effective alternative if CO2 unavailable (25-35% reduction)
- Gentle insertion technique — your skill matters most (60-65% reduction)
- Strategic sedation — tailored to patient need (30-50% reduction)
- Expert communication — builds confidence and reduces pain perception

THE OUTCOMES (WHAT THIS MEANS)

- Higher screening completion rates



- Better adenoma detection rates
- Improved patient satisfaction
- Increased likelihood of future screening compliance
- More referrals from satisfied patients

WHAT YOU'LL PRACTICE TODAY

- Recognizing loop deformation patterns in simulator
- Gentle insertion techniques with minimal push force
- CO2 insufflation workflow
- Communication with nursing team
- Handling difficult anatomy without causing pain

CLINICAL PEARL: THE "PAIN-FREE MOMENT" RECOGNITION

When patients report ZERO pain at cecum, it's because:

1. Excellent bowel prep (no loops needed)
2. CO2 used (no distension pain)
3. Gentle technique (minimal mechanical pain)
4. Good communication (patient not anxious)

This combination is REPRODUCIBLE.

It's not luck. It's not anatomy. It's technique plus technology plus communication.

Goal for This Course:

Make pain-free colonoscopy your norm, not your exception.

EVIDENCE SUMMARY: WHAT THE RESEARCH SHOWS

Intervention	Pain Reduction	Evidence Level	Cost	Feasibility
CO2 insufflation	30-40%	Strong (Meta-analysis)	Low	High
Water exchange	25-35%	Strong (RCTs)	Low	High
Gentle technique	60-65%	Strong (Observational)	None	High (training)
Variable-stiffness scope	20-25%	Moderate (RCTs)	Medium	Device dependent
Moderate sedation	30-50%	Strong (Multiple RCTs)	Low	High
Patient communication	15-25%	Moderate (Observational)	None	High

NOTES FROM THE LECTURE

Use this space to write your own observations during the lecture:

QUESTIONS FOR REFLECTION



1. What is the single biggest change I can make to reduce patient pain immediately?

Answer: _____

2. Which deformation pattern do I most commonly create, and how will I change it?

Answer: _____

3. How will I modify my patient communication before procedures?

Answer: _____

4. What simulator practice do I need to focus on today?

Answer: _____

5. How will I track pain scores in my practice to measure improvement?

Answer: _____

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