Postoperative Pain Management:
Getting the best outcomes for your patients

Jeremy Warren, MD FACS

University of South Carolina School of Medicine Greenville
Prisma Health Upstate

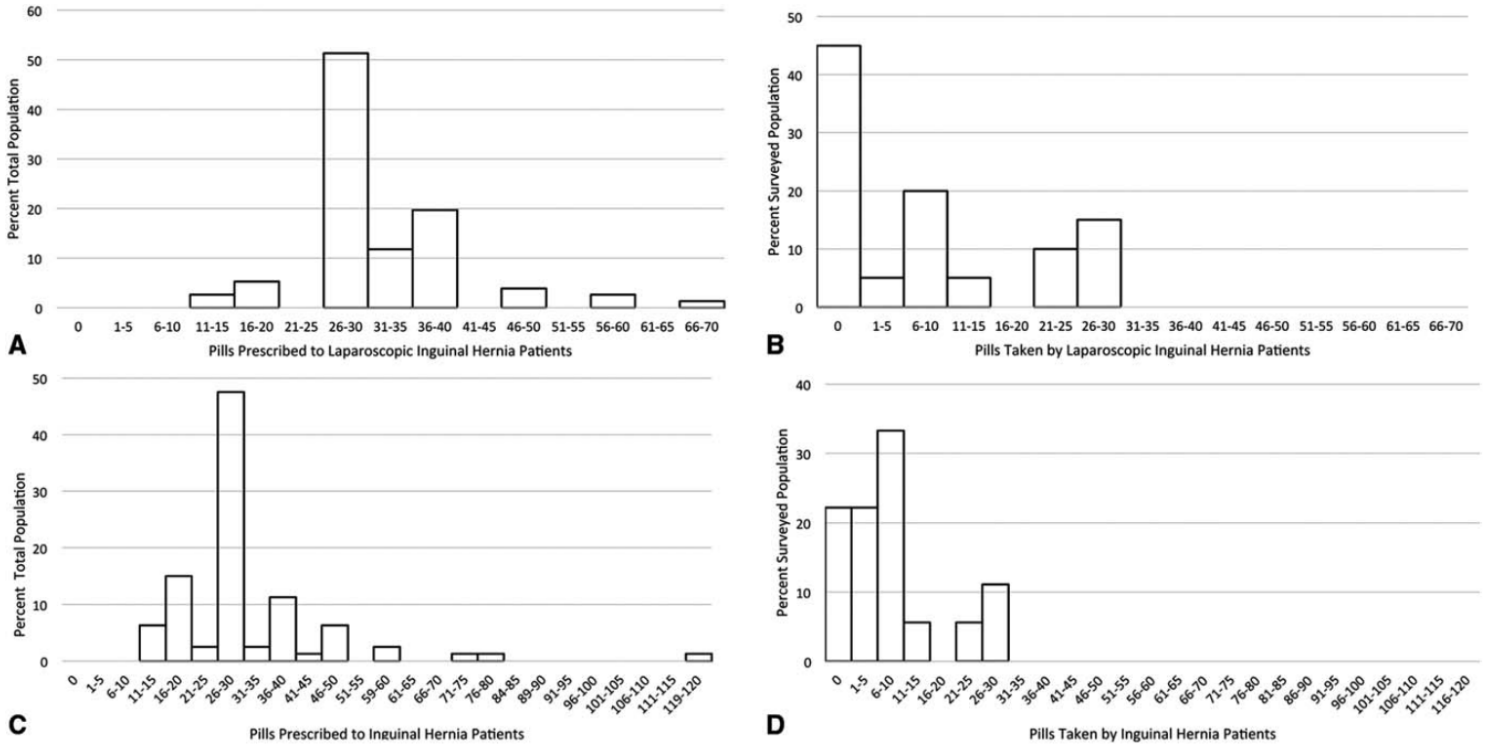
Disclosures

Intuitive Surgery:	consultant
Johnson & Johnson (Ethicon):	speaker
Board member / treasurer ACHQC	

Background

Wide Variation and Excessive Dosage of Opioid Prescriptions for Common General Surgical Procedures

Prescribed



Consumed

Hill MV, et al. *Ann Surg*. 2017;265(4):709-714

Background

Guideline for Discharge Opioid Prescriptions after Inpatient General Surgical Procedures

Table 2. Home Opioid Use of Patients Analyzed after Inpatient Discharge

Variable	Bariatric (n = 83)	Foregut (n = 33)	Hepatectomy (n = 12)	Pancreatectomy (n = 10)	Colectomy (n = 69)	Ventral hernia (n = 27)	Total (n = 234)
Questionnaires completed, n (%)	68 (81.9)	32 (94.2)	11 (84.6)	10 (100)	64 (92.7)	25 (83.3)	210 (89.7)
Phone	38 (55.9)	20 (62.5)	8 (72.7)	6 (60)	28 (43.8)	13 (52)	113 (53.8)
Paper	30 (44.1)	12 (37.5)	3 (27.3)	4 (40)	36 (56.2)	12 (48)	97 (46.2)
No. of pills prescribed	1,921	753	153	169	1,022	639	4,657
No. of pills taken, n (%)	650 (33.8)	339 (45.0)	82 (53.6)	63 (37.3)	201 (19.7)	341 (53.4)	1,776 (38.1)
Mean (SD)	9.7 (14.8)	10.6 (13.6)	7.5 (10.3)	6.3 (7.3)	4.7 (10.3)	14.2 (23.1)	
Median	4	6	0	4	0	5	
Range	0–79	0–75	0–28	0–20	0–62	0–100	
Refills, n (%)	3 (4.4)	3 (9.4)	1 (9.0)	1 (10)	2 (2.9)	4 (16)	14 (6.5)

Hill MV, et al. *JACS*. 2018;226(6):996-1003

Prisma Experience

Effect of Multimodal Analgesia on Opioid Use After Open Ventral Hernia Repair

	Control	Epidural only	Ketamine only	ERAS: ketamine + epidural	*p* value
Complications	0 (0)		0 (0)	3 (8.11)	0.199
SSO	6 (17.14)	7 (18.42)	3 (23.08)	6 (16.22)	0.947
SSI	0 (0)	3 (7.89)	0 (0)	4 (10.81)	0.183
Readmission	1 (2.86)	3 (7.89)	3 (23.08)	1 (2.7)	0.077
Drains	28 (80)	36 (94.74)	3 (23.08)	37 (100)	< 0.001
LOS	4.3 ± 2.0	6.0 ± 3.6	3.2 ± 1.5	5.4 ± 3.1	0.009
Intraop fluids	2648 ± 1034	2162 ± 1013	2162 ± 977	2596 ± 1009	0.382
PCA use	23 (65.71)	26 (68.42)	0 (0)	1 (2.7)	< 0.001
MSO_4 eq, median (IQR)					
Periop	47.6 (34.3, 70.6)	29.5 (18.2, 36.7)	11.6 (8.0, 16.0)	6.4 (0, 10)	< 0.001
POD1	40.0 (11.8, 61.5)	18.2 (6.7, 39.0)	10 (0, 35.0)	5 (0, 20.0)	< 0.001
POD2	28.3 (7.5, 53.0)	19.8 (5.3, 30.0)	7 (0, 18.3)	7.5 (0, 20.0)	0.004
POD3	13.3 (0, 27.0)	9.5 (0, 15.0)	12.0 (1.6, 13.3)	12 (1.6, 20.0)	0.167

System Changes:

- Ketamine infusions
- Change anesthesia meds
  - Eliminate fentanyl
  - Decrease dose dilaudid
- Opioid stewardship task force

Warren JA, et al. *J Gastrointest Surg*. 2017;21:1692-99

Prisma Experience

Prescribing Protocol

Outpatient

First Line: Ibuprofen 800mg TID x 20 pills
Alternate with
Tylenol 650 – 1000 mg QID x 20 pills (adjust / remove if narcotic/APAP prescribed)
Second Line: Robaxin 500mg TID
Third Line: *Based on surgeon discretion OR patient discussion preop*
Tramadol 50mg q 6 hrs x 5 pills (25 MME)
OR
Norco 5/325mg q 8 hrs x 5 pills (25 MME)
OR
Oxycodone 5mg q 8 hrs x 4 pills (30 MME)

Outpatient: Complex

First Line: Ibuprofen 800mg TID x 20 pills
Alternate with
Tylenol 650 – 1000mg QID x 20 pills* (adjust / remove if narcotic/APAP prescribed)
Second Line: Robaxin 500ml TID
Third Line: *Based on surgeon discretion OR patient discussion preop*
Tramadol 50mg q 6 hrs x 12-15 pills (60 - 75 MME)
OR
Norco 5/325mg q 8 hrs x 12-15 pills (60 - 75 MME)
OR
Oxycodone 5mg q 8 hrs x 10 pills (75 MME)

Prisma Experience

Prescribing Protocol

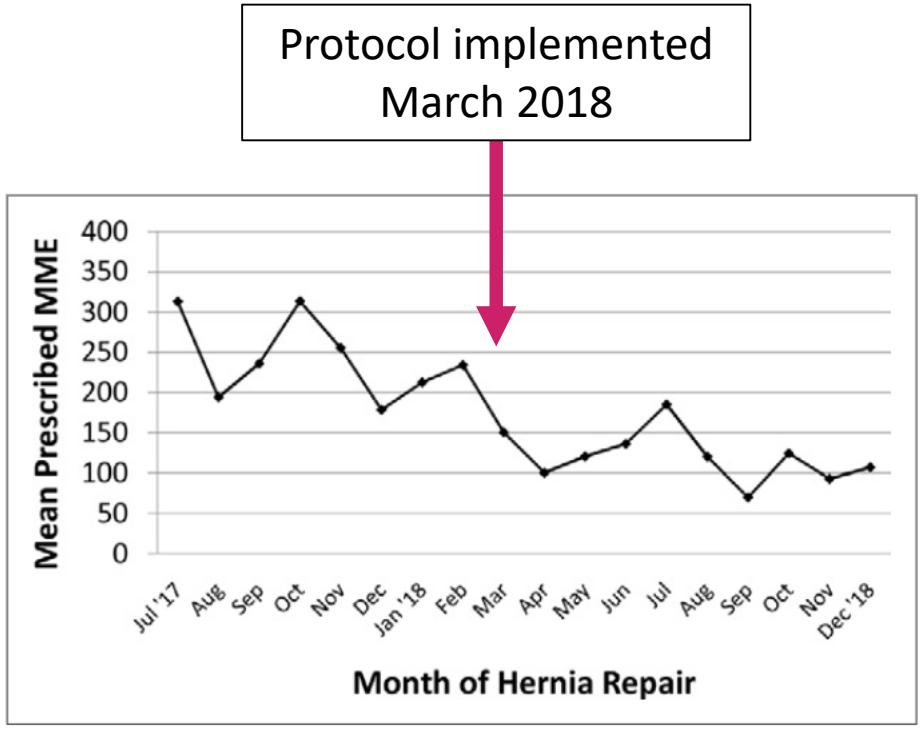
Inpatient

No. MME last 24 hrs	Rec. discharge dose (total MME)	Medication equivalent
0-5 (0-1 pills)	15	hydrocodone 5mg x 3 tramadol 50mg x 3 oxycodone 5mg x 2
6-15 (2-3 pills)	40	hydrocodone 5mg x 8 oxycodone 5mg x 6 tramadol 50mg x 8
16-30 (4-6 pills)	80	hydrocodone 5mg x 16 oxycodone 5mg x 12 tramadol 50 mg x 16
>30 (>6 pills)	100	hydrocodone 5mg x 20 oxycodone 5mg x 15 tramadol 50mg x 20

Prisma Experience

Implementation of an Evidence-Based Protocol Significantly Reduces Opioid Prescribing After Ventral Hernia Repair

	PRE	POST	*P* value
N	105	75	
Total MME			
Mean ± SD	322.7 ± 261.3	141.6 ± 150.4	<.001
Median (IQR)	225 (150-400)	100 (50-184)	<.001
Refills	21 (20)	8 (10.67)	.141



Peterman DE, et al. *Am Surg*. 2020;86(1):1602-1606

Prisma Experience

Implementation of a Patient-Tailored Opioid Prescribing Guideline in Ventral Hernia Surgery

Outcome	Total sample $n = 163$	Standard care group $n = 121$ (74.23%) Median (IQR)	Guideline-based care group $n = 42$ (25.77%) Median (IQR)	P-value
Total MME prescribed at discharge	90.00 (60.00-150.00)	100.00 (60.00-150.00)	65.00 (50.00-75.00)	<0.0001*
Proportion of patients with an opioid refill within 30 d following discharge, *n (%)*	24 (14.72)	16 (13.22)	8 (19.05)	0.3587†
Total MME of opioid refill prescription(s) within 30 d following discharge	116.25 (75.00-187.50)	150.00 (75.00-262.50)	75.00 (55.00-120.00)	0.1085*
Total MME prescribed at discharge + opioid refill(s) prescribed within 30 d following discharge	100.00 (60.00-150.00)	112.50 (75.00-150.00)	75.00 (50.00-100.00)	0.0013*

Outcome	Total sample $n = 86$	Standard care group $n = 61$ (70.93%) Mean (SD)	Guideline-based care group $n = 25$ (29.07%) Mean (SD)	P-value
PROMIS pain score		56.67 (10.16)	57.26 (11.89)	0.8169*
HerQLes quality-of-life score		46.56 (26.50)	53.07 (26.56)	0.3073*

Lindros SH, et al. *J Surg Rsrch*. 2023;282:109-117

Prisma Experience

Impact of methocarbamol on opioid use after primary ventral and inguinal hernia repair

Characteristic	Methocarbamol Group	PM Controls	p-value
Opioids prescribed at discharge	29 (55.8)	94 (90.4)	<0.001*
Total MME prescribed at discharge Median (IQR)	20 (0, 45)	50 (25, 75)	<0.001*
Opioid refill required	2/29 (6.9)	1/94 (1.1)	0.075
Rescue opioid required	1/23 (4.6)	0/10 (0.0)	0.493
Opioids prescribed at discharge	35 (67.3)	91 (87.5)	0.003*
Total MME Rx at discharge Median (IQR)	25 (0, 25)	40 (25, 50)	<0.001*
Opioid Refill Required	3/35 (8.6)	0/91 (0.0)	0.005*
Rescue opioid required	1/17 (5.9)	0/13 (0.0)	0.374

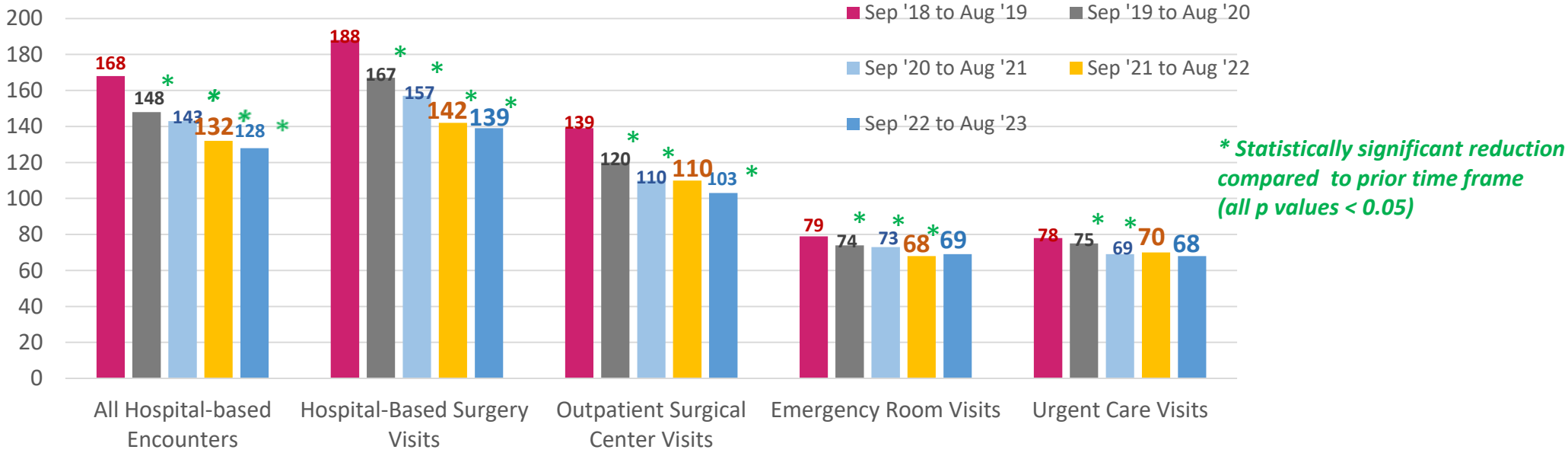
Impact of methocarbamol on opioid use after ventral incisional hernia repair

Characteristic	Robaxin group	PM Controls	p-value
Number of patients	101	202	–
Admit to hospital >24 h	66 (54.1)	125 (62.8)	0.123
Inpatient Total MME Median (IQR)	23 (8, 100)	25 (8, 65)	0.847
Opioids prescribed at discharge	88 (87.1)	175 (86.6)	0.904
Median MME Rx at discharge Median IQR	60 (40, 75)	75 (50, 80)	0.021*
Opioid Refill Required	11/88 (12.5)	29/175 (16.6)	0.386
Rescue Opioid Required	2/13 (15.4)	0/27 (0.0)	0.037*

Crosier C, et al. *Am J Surg*. 2023;226(6):813-816
Desai S, et al. *Am J Surg*. 2023;226(6):858-863

Prisma Experience

Average Total Discharge MME



** Statistically significant reduction compared to prior time frame (all p values < 0.05)*

No. of RX Sep ’18 to Aug ’19	31,557	11,353	1,236	9,515	1,126
No. of Rx Sep ‘19 to Aug ‘20	32,409	12,460	1,536	9,415	1,254
No. of Rx Sep ‘20 to Aug ‘21	33,433	12,545	2,185	8,989	1,116
No. of Rx Sep ’21 to Aug ‘22	39,008	14,326	2,782	10,741	1,310
No. of RX Sep ’22 to Aug ‘23	38,282	14,830	2,495	10,514	402

Opioid Reduction Task Force

Utilization of a National Registry to influence opioid prescribing behavior after hernia repair

- Concept presented and developed 2018.
- Module introduced March 2019.
  - Collect prescription details, patient risk factors, *and* patient reported opioid consumption

Reinhorn M, et al. *Hernia*. 2022;26:847-853

Opioid Reduction Task Force

Utilization of a National Registry to influence opioid prescribing behavior after hernia repair

	All inguinal hernia ($n=443$)
Prescribed opioid tablets	
< 10 tablets	198 (44.7)
10–20 tablets	145 (32.7)
> 20 Tablets	100 (22.6)
Patient reported consumption	$n=277$
≤ 10 tablets	225 (81.2)
11–15 tablets	112 (40.4)
> 15 tablets	133 (48.0)
Preferred not to answer	2 (0.7)

55.3%

81.2%

	All ventral hernia repair ($n=398$)
Prescribed opioid tablets	n (%)
< 10 tablets	71 (17.8)
10–20 tablets	158 (39.7)
> 20 Tablets	169 (42.5)
Patient reported consumption	$n=217$
≤ 10 tablets	142 (65.4)
11–15 tablets	22 (10.1)
> 15 tablets	44 (20.3)
Preferred not to answer	9 (4.1)

82.2%

65.4%

Reinhorn M, et al. *Hernia*. 2022;26:847-853

Opioid Reduction Task Force

Higgins RM, et al. *Hernia*. 2022;265(4):855-864

The opioid reduction task force: using the ACHQC Data Registry to combat an epidemic in hernia patients

Rx for umbilical hernia

	Pre-summit	Post-summit	*p* value
Overall	*n* = 353	*n* = 830	< 0.001*
0 tablets	30 (9%)	88 (11%)	
1–10 tablets	181 (51%)	514 (62%)	
> 10 tablets	142 (40%)	228 (27%)	

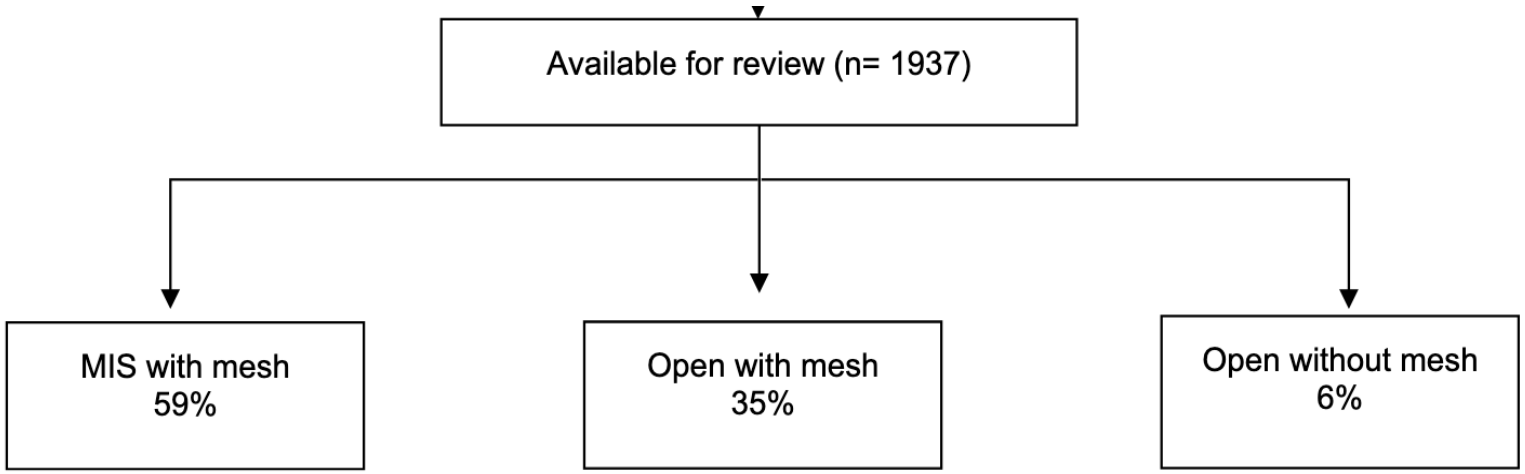
Rx for inguinal hernia

	Pre-summit	Post-summit	*p* value
Overall	*n* = 976	*n* = 2447	< 0.001*
0 tablets	68 (7%)	456 (19%)	
1–10 tablets	585 (60%)	1324 (54%)	
> 10 tablets	323 (33%)	667 (27%)	

Overall reduction in MME prescribed:
95.9 vs 79.5
Increased surgeon participation:
52 → 91
Reduction in high-prescribing (>10):
40 → 27% umbilical
33→ 27% inguinal
Reduction in high (>10) PRO consumption:
21→ 12% umbilical
15 → 6% inguinal

Opioid Reduction Task Force

Predictors of low and high opioid tablet consumption after inguinal hernia repair: an ACHQC opioid reduction task force analysis



Perez AJ, et al. *Hernia*. 2022;26:1625-1623

Opioid Reduction Task Force

Predictors of low and high opioid tablet consumption after inguinal hernia repair: an ACHQC opioid reduction task force analysis

Predictors of taking ***zero*** opioids

Surgeon modifiable

- Avoid preoperative opioids
- Use local anesthetic
- Prescribe fewer opioids

	OR	95% CI	*p*-value
Older age—for an increase in 20 years	1.55	1.34–1.79	**<0.001**
Gender (male:female)	1.31	0.86–2.00	0.20
Current smoker	0.65	0.43–0.98	0.61
ASA ≤2	1.56	1.22–2.01	**<0.001**
Substance use history	1.24	0.82–1.87	0.31
Any behavioral health history	0.90	0.62–1.32	0.60
No preoperative opioid use at baseline	2.29	1.31–4.03	**0.004**
Local anesthetic with general anesthesia[a]	1.39	1.05–1.85	**0.022**
Local anesthetic with sedation[a]	2.20	1.53–3.15	**<0.001**
Bilateral	1.03	0.79–1.33	0.83
Open mesh vs Open non-mesh repair	1.32	0.80–2.18	0.27
Open mesh vs Lap/Robotic mesh repair	1.07	0.81–1.42	0.62
Previous mesh present	1.01	0.63–1.60	0.98
OR time <1 h	1.39	1.12–1.72	**0.003**
Prescribing fewer opioid tablets (in increments of 7)	2.27	1.96–2.62	**<0.001**
EuraHS-QoL[b] Pain domain at baseline	0.84	0.70–1.01	0.059

Perez AJ, et al. *Hernia*. 2022;26:1625-1623

Opioid Reduction Task Force

Predictors of low and high opioid tablet consumption after inguinal hernia repair: an ACHQC opioid reduction task force analysis

Predictors of taking ***>10*** opioids

Surgeon modifiable

- Avoid preoperative opioids
- MIS approach
- Prescribe fewer opioids

	OR	95% CI	*p*-value
Younger age—for a decrease in 20 years	1.96	1.51–2.55	**<0.001**
Gender (male:female)	0.78	0.38–1.61	0.51
Current smoker	2.67	1.61–4.44	**<0.001**
ASA > 2	1.80	1.16–2.79	**0.009**
Substance use history	0.93	0.52–1.64	0.79
Any behavioral health history	0.90	0.45–1.82	0.78
Preoperative opioid use at baseline	2.24	1.14–4.37	**0.02**
Local anesthetic with general anesthesia[a]	0.63	0.36–1.11	0.11
Local anesthetic with sedation[a]	0.97	0.49–1.89	0.92
Bilateral	1.12	0.73–1.85	0.51
Open mesh vs Open non-mesh repair	2.19	1.37–3.50	**0.001**
Open mesh vs Lap/Robotic mesh repair	1.53	1.13–2.05	**0.005**
Previous mesh present	1.36	0.66–2.77	0.40
OR time > 1 h	1.25	1.14–1.75	**0.002**
Prescribing more opioid tablets (in increments of 7)	3.32	2.64–4.18	**<0.001**
EuraHS-QoL[b] Pain Domain at Baseline	1.53	1.13–2.05	**0.005**

Perez AJ, et al. *Hernia*. 2022;26:1625-1623

Leveraging the QC

Can we identify best techniques to optimize outcomes *and* optimize recovery?

Posterior mesh inguinal hernia repairs: a propensity score matched analysis of laparoscopic and robotic versus open approaches

Table 3 MIS vs open propensity score matched outcomes

Adjusted outcome analysis	MIS posterior (TAPP/TEP) ($N=816$)	Open posterior (TREPP) ($N=816$)	*P* value	OR	95% CI
Patient reported opioid use in last 30-days at 30-day follow-up			<0.001	0.261	(0.192, 0.352)
0	227/408 (55.64)	391/475 (82.32)			
1–4	106/408 (25.98)	63/475 (13.26)			
5–10	55/408 (13.48)	17/475 (3.58)			
11 or more	20/408 (4.90)	4/475 (0.84)			

Reinhorn M, et al. *Hernia*. 2022 [epub]

Leveraging the QC

Improved patient-reported outcomes after open preperitoneal inguinal hernia repair compared to anterior Lichtenstein repair: 10-year ACHQC analysis

	Lichtenstein	TREPP	P-value
EuraHS score: baseline Median (mean)	21 (26.24)	24 (27.6)	0.589
EuraHS score: 30-day Median (mean)	15 (18)	8 (12.56)	<0.001*
EuraHS score: 6-mos Median (mean)	2 (5.22)	1 (4.08)	0.256
EuraHS score: 1-yr Median (mean)	2 (5.02)	1 (3.59)	0.047*
Reported opioid use 0 1-4 ≥ 5	 58.48% 21.64% 19.88%	 80.89% 14.67% 4.44%	<0.001*

Agarwal, et al. *Hernia*. 2023;27:1139-1154

Leveraging the QC

Are adjunctive non-opioid analgesics effective?

Impact of methocarbamol on opioid use after ventral incisional hernia repair

Opioid Rx reduced with addition of methocarbamol:

- 75 vs 60 MME
- No increase in refills or rescue opioids

Impact of methocarbamol on opioid use after primary ventral and inguinal hernia repair

Opioid Rx reduced with addition of methocarbamol:

- 55.8 vs 90.4% prescribed zero
- 50 vs 20 MME
- No increase in refills or rescue opioids

Crosier C, et al. *Am J Surg*. 2023;226(6):813-816
Desai S, et al. *Am J Surg*. 2023;226(6):858-863

Leveraging the QC

Pilot RCT on impact of methocarbamol

Table 1: Impact of methocarbamol on opioid use after inguinal hernia repair

Characteristic	M+	M-	p-value
Number of Patients	21	16	---
Age – Years			
Median (IQR)	62 (53, 70)	60 (55, 70)	0.830
Gender Male: No. (%)	19 (90.5)	14 (87.5)	1.000
Pain score @ 2 days			
Median (IQR)	3 (2.5, 5)	3.5 (2, 5)	0.771
Pain score @ 7 days			
Median (IQR)	2 (1, 3)	2 (1, 4)	0.629
Rescue/ Refill: No. (%)	3 (14.3)	0 (0)	0.243
Patient reported opioid use			
at 30 days: No. (%)			
Any	3 (14.3)	8 (50.0)	0.030*
Patient reported opioid use (# pills taken)			
at 30 days: No. (%)			
0	18 (85.7)	8 (50.0)	0.019*
1-2	0	1 (6.2)	
3-4	0	4 (25.0)	
5-10	2 (9.5)	3 (18.8)	
11-15	0	0	
16-30	1 (4.8)	0	

Table 1: Impact of methocarbamol on patient-reported opioid use after open VHR

Characteristic	M+	M-	p-value
Number of Patients	17	19	---
Age – Years			
Median (IQR)	64 (61, 69)	55 (45, 67)	0.068
Gender Male: No. (%)	10 (58.8)	8 (42.1)	0.505
Pain score @ 2 days			
Median (IQR)	4.5 (2, 7.5)	4 (2, 7)	0.652
Pain score @ 7 days			
Median (IQR)	3.5 (0.5, 4.5)	2 (1, 4)	0.827
Rescue/ Refill: No. (%)	2 (11.8)	0 (0)	0.216
Patient reported opioid use			
at 30 days: No. (%)			
Any	6 (35.3)	15 (79.0)	0.017*
Patient reported opioid use (# pills taken)			
at 30 days: No. (%)			
0	11 (64.7)	4 (21.0)	0.023*
1-2	2 (11.8)	3 (15.8)	
3-4	0	6 (31.6)	
5-10	3 (17.6)	3 (15.8)	
11-15	1 (5.9)	3 (15.8)	

Leveraging the QC

The impact of opioid versus non-opioid analgesics on postoperative pain level, quality of life, and outcomes in ventral hernia repair

Table 2 PROMIS Pain 3a scores before and after propensity score matching

	Unmatched			Matched		
	Opioids N = 948	Non-opioids N = 103	P-Value	Opioids N = 188	Non-opioids N = 94	P-value
PROMIS 3a pain score at baseline, median (IQR)	45 (36–52)	44 (31–49)	0.002	40 (31–49)	42 (31–49)	0.66
PROMIS 3a pain score at 30 day, median (IQR)	46 (40–52)	40 (31–46)	< 0.001	44 (40–49)	40 (31–46)	0.012
PROMIS 3a pain score at 30 day (change from baseline), median (IQR)	0.0 (−5.6–9.5)	0.0 (−5.9–5.9)	0.058	1.2 (−3.2–9.5)	0.0 (−5.9–5.9)	0.011
PROMIS 3a pain score at 1 year, median (IQR)	31 (31–44)	31 (31–40)	0.19	31 (31–40)	31 (31–40)	0.46
PROMIS 3a pain score at 1 year (change from baseline), median (IQR)	−5.8 (−13.1–0.0)	−3.3 (−12.8–0.0)	0.079	−3.3 (−12.8–0.0)	−2.9 (−10.6–0.0)	0.57

Alzatari R, et al. *Hernia*. 2024

Ongoing / Future Study

Opioid over-prescription after outpatient, mesh-based ventral hernia repair

2795 patients with same day/next day discharge:

	Consumed <10
Open (1288)	87.7%
MIS intraperitoneal mesh (635)	78.4%
MIS RM/PP (872)	84.2%

The more prescribed, the more consumed

and

The more prescribed, the more unused

Conclusion

- Multimodal analgesia works!
- Inguinal and primary ventral hernias do not need opioids.
- 80% of patients need <10 opioid tablets even after more complex VHR.
- Talk to your patients