Office of Evidence Based Practice (EBP) – Critically Appraised Topic (CAT): Use of Transverse Abdominal Plane (TAP) blocks and reduction of pain in laparoscopic gastric bypass patients

Specific Care Question

In pediatrics, does a Transverse Abdominal Plane (TAP) block reduce post-op pain in patients undergoing laparoscopic gastric bypass versus the surgeon injecting local anesthetic in the abdomen?

Recommendations Based on Current Literature (Best Evidence) Only

A conditional recommendation is made for the use of TAP blocks in laparoscopic gastric bypass surgeries, based on the GRADE Evidence to Decision instrument[a], the Summary of Findings Table[c]. The overall certainty in the evidence is moderate to very low[a] for use of TAP blocks in reduction of postoperative opioid need and consumption. However, subjective data collected on patients' pain level using a visual analogue scale (VAS) showed the evidence is of low to very low evidence[a] for pain level reduction at zero hours and 24 hours postoperative requiring additional data to determine a recommendation for the use of TAP blocks if based on subjective data alone- see Summary by Outcome for substantiation of recommendations.

Literature Summary

Background The American Society for Metabolic and Bariatric Surgery Pediatric Committee recognizes obesity as a disease (Pratt et al., 2018). Severe obesity is on the rise among the pediatric population and disproportionately impacts adolescents (Armstrong et al., 2019). As of December 2020, the childhood obesity rate is 21.2% for adolescents aged 12 to 19, 20.3% for children aged 6 to 11, and 13.4% for children 2 to 5 years old (Robert Wood Johnson Foundation, 2020). Severe obesity contributes to multiple health issues in children, placing them at risk for poor health throughout their lifespans (Estrada et al., 2014; Skinner et al., 2015). For severely obese youth, bariatric surgery is recommended and identified as a safe and appropriate intervention after other interventions (lifestyle change, nutrition support, and medication) have failed (Pratt et al., 2018).

Bariatric surgeries in adults and adolescents are now primarily performed laparoscopically (Ruiz-Tovar et al., 2020). Although, laparoscopic surgeries have helped decrease postoperative pain, it is still present (Ruiz-Tovar et al., 2020). Many programs utilize an Enhanced Recovery After Surgery (ERAS) method that emphasizes a multimodal analgesic approach to reduce postoperative pain, resulting in less postoperative opioid use and a shortened length of stay (Aktimur et al., 2018; DeOliveira et al., 2018). One potential solution to reduce post-operative pain for gastric sleeve bypass surgeries includes the transverse abdominal pain (TAP) block (Wassef et al., 2013). This review will summarize identified literature to answer the specific care question on the use and efficacy of TAP blocks in gastric bypass surgeries to reduce post-operative pain from both subjective and objective data.

Study Characteristics

The search for suitable studies was completed on July 16, 2021. Christian Taylor, DO and Todd Glenski, MD reviewed the 18 titles and/or abstracts found in the search and identified[b] 10 single studies believed to answer the question. After an in-depth review of the identified single studies[b], six were determined to answer the question.

Is post-op pain reduced in gastric sleeve patients receiving TAP blocks? After reviewing the six studies determined to meet the criteria for analysis in this review, five studies (Albrecht et al., 2013; McCarthy et al., 2020; Ruiz-Tovar et al., 2018; Ruiz-Tovar et al., 2020; Sinha, Jayaraman & Punhani, 2013) provided the comparison on opioid rescues post operation for gastric bypass patients receiving either the experimental TAP block or standard of care, no TAP block. Total opioids provided within a 24-hour period was the analysis pulled by the reviewers.

Three studies (Albrecht et al., 2013; Robertson et al, 2019; Sinha, Jayaraman & Punhani, 2013) provided the comparison on VAS pain scores immediately following surgery for gastric bypass patients receiving TAP blocks to those that received no TAP blocks. Only dichotomous data was provided for this comparison within the three articles.

Five studies (Albrecht et al., 2013; Robertson et al, 2019; Ruiz-Tovar et al., 2018; Ruiz-Tovar et al., 2020; Sinha, Jayaraman & Punhani, 2013) provided the comparison on VAS pain scores at 24 hours post operation for gastric bypass patients receiving TAP blocks to those that received no TAP blocks. Both dichotomous and continuous data was provided and analyzed for this comparison.

Summary by Outcome

Opioid Need First 24 hours

Five studies (Albrecht et al., 2013; McCarthy et al., 2020; Ruiz-Tovar et al., 2018; Ruiz-Tovar et al., 2020; Sinha, Jayaraman & Punhani, 2013) measured the need for opioid pain medication within the first 24 hours post operation following bariatric gastric sleeve bypass surgery, (*n* = 434). For the three RCTs (Ruiz-Tovar et al., 2018; Ruiz-Tovar et al., 2020; Sinha, Jayaraman & Punhani, 2013) using dichotomous data (*n* = 377), the *OR* = 0.14, 95% CI [.0.7, 0.28], *p* = .00001, indicated the intervention of a TAP block was favorable to the comparator of no TAP block for decreasing the need of opioid rescue? medication following gastric sleeve surgery (see Figure 2 & *Table 1*). For the RCT (Albrecht et al., 2013) (*n* = 57), the *MD* = -3.40, 95% CI [-11.42, 4.62], *p* = .14, indicated the intervention of a TAP block was no different to the comparator (no TAP block) for decreasing the need of opioid pain medication following gastric sleeve surgery (see Figure 3 & *Table 1*). For the one cohort study (McCarthy et al., 2020) (*n* = 509), the IQR difference of -15, 95% CI [-20, -2], *p* = < 0.01, indicated the intervention of TAP block was favorable to the comparator of no TAP block for decreasing the need of opioid pain medication following gastric sleeve surgery; results from the cohort study are not included in the meta-analysis due to the use IQR. Based on the data presented (Ruiz-Tovar et al., 2018; Ruiz-Tovar et al., 2020; Sinha, Jayaraman, & Punhani, 2013), the use of TAP blocks in gastric sleeve surgeries will result in 183 to 255 fewer requests or need for opioid pain medication per 1,000 patients.

> **Certainty Of The Evidence For Opioid Need In First 24 hours.** The certainty of the body of evidence was very low based on four factors[a]: *within-study risk of bias*, *consistency among studies, directness of evidence*, and *precision of effect estimates*. The body of evidence was assessed to not have serious risk of bias or serious inconsistency, although the evidence did have serious indirectness and imprecision. Serious indirectness due to reference to adult studies (*n* = 5) and serious imprecision was found in the body of evidence due to limited number of participants (*n* = 377) and limited number of events (*n* = 66).

Pain at Zero Hours Post-Surgery

Three studies (Albrecht et al., 2013; Robertson et al, 2019; Sinha, Jayaraman & Punhani, 2013) measured pain levels at zero hours post-surgery for gastric sleeve bypass, (*n* = 418). For the two RCTs (Albrecht et al., 2013; Sinha, Jayaraman & Punhani, 2013) (*n* = 157), the *OR* = .92, 95% CI [0.32, 2.71], *p* = .89, indicated the intervention of a TAP block was not different to the comparator of standard care in reducing reports of pain immediately following surgery (see Figure 4 & *Table 1*). The one cohort study (Robertson et al., 2019) (*n* = 235), *OR* = 2.01, 95% CI [0.62, 6.51], *p* = .25, indicated the intervention of a TAP block was not different to the comparator of standard care in reducing reports of pain immediately following surgery (see Figure 5 & *Table 1*). Based on the data presented for the two RCT studies (Albrecht et al., 2013; Sinha, Jayaraman & Punhani, 2013), the use of TAP blocks in gastric sleeve surgeries will result in 66 to 131 fewer reports of pain per 1,000 patients within the first hour post-surgery. In the one cohort study, the use of TAP block in gastric sleeve surgeries would result in 13 to 152 fewer reports of pain per 1,000 patients within the first hour post-surgery.

> **Certainty Of The Evidence For Pain At Zero Hours Post-Surgery** The certainty of the body of evidence was low for the two RCTs but very low for the one cohort study based on four factors[a]: *within-study risk of bias*, *consistency among studies, directness of evidence*, and *precision of effect estimates*. The body of evidence was assessed to not have serious risk of bias or serious inconsistency, but serious indirectness and serious imprecision. All three studies (Albrecht et al., 2013; Robertson et al, 2019; Sinha, Jayaraman & Punhani, 2013) demonstrated serious indirectness due to reference to adult studies and serious imprecision due to low number of participants (*n* = 410) and low number of events (*n* = 27).

Pain at 24 hours Post-Surgery

Five studies (Albrecht et al., 2013; Robertson et al, 2019; Ruiz-Tovar et al., 2018; Ruiz-Tovar et al., 2020; Sinha, Jayaraman & Punhani, 2013) measured pain levels at 24 hours post-surgery for gastric sleeve bypass, (*n* = 687). For the two RCT studies (Albrecht et al., 2013; Sinha, Jayaraman & Punhani, 2013) using dichotomous data (*n* = 157), the *OR = 1.09,* 95% CI [0.28, 4.31], *p* = .90, indicated the intervention of TAP block was not different to the comparator of standard care (see Figure 6 & *Table 1*). For the two RCT studies (Ruiz-Tovar et al., 2018; Ruiz-Tovar et al., 2020) using continuous data (*n* = 277), the *MD* = -11.62, 95%CI [-14.16, -9.09], *p* = <.00001, indicated the intervention of TAP blocks was favorable to the comparator of no TAP blocks

(see Figure 7 & *Table 1*). For the one cohort study (Robertson et al., 2019) using dichotomous data (n = 253), the *OR* = 1.14, 95% CI [0.40, 4.98], p = .60, indicated the intervention of TAP blocks was not different to the comparator of standard care (see Figure 8 & *Table 1*).

Certainty Of The Evidence For Pain at 24 hours Post-Surgery The certainty of the body of evidence was low for the two RCTs reporting dichotomous data (Albrecht et al., 2013; Sinha, Jayaraman & Punhani, 2013), very low for the two RCTs reporting continuous data (Ruiz-Tovar et al., 2018; Ruiz-Tovar et al., 2020) and very low for the one cohort study (Robertson et al., 2019) based on four factors[a]: *within-study risk of bias*, *consistency among studies, directness of evidence*, and *precision of effect estimates*. The body of evidence for the two RCT studies and one cohort study providing dichotomous data, was assessed to not have serious risk of bias or inconsistency, but serious indirectness and imprecision. Serious indirectness was due to use of adult only studies and serious imprecision due to low number of events (n = 410) and low number of participants (n = 18). For the two RCT studies providing continuous data, the body of evidence was assessed to not have serious risk of bias or imprecision but serious indirectness due to use of adult studies and very serious inconsistency due to heterogeneity of 95%.

Identification of Studies

Search Strategy and Results (see Figure 1)

("Gastric Bypass"[Mesh] OR gastric bypass) AND ("Anesthesia, Local"[Mesh] OR transversus abdominis plane OR Transverse Abdominal Plane block OR TAP [tiab])

Records identified through database searching n = 18

Additional records identified through other sources n = 0

Studies Included in this Review

Citation	Study Type
*Albrecht et al., 2013	RCT
McCarthy et al., 2020	Cohort
*Robertson et al., 2019	Cohort
*Ruiz-Tovar et al., 2018	RCT
*Ruiz-Tovar et al., 2020	RCT
*Sinah et al., 2013	RCT

References marked with an asterisk indicate studies included the meta-analysis

Studies Not Included in this Review with Exclusion Rationale

Citation	Reason for exclusion
Anderson et al, 2014	Only two individual studies from this SR answered the question
Jarrar et al, 2020	Provided protocol vs. study
Moncada et al, 2016	Wrong intervention
Wong et al, 2020	Wrong intervention

Methods Used for Appraisal and Synthesis

[a]The GRADEpro Guideline Development Tool (GDT) is the tool used to create the Summary of Findings table(s) for this analysis.

[a]GRADEpro GDT: GRADEpro Guideline Development Tool (2015). McMaster University, (developed by Evidence Prime, Inc.). [Software]. Available from gradepro.org.

[b]Rayyan is a web-based software used for the initial screening of titles and / or abstracts for this analysis (Ouzzani, Hammady, Fedorowicz & Elmagarmid, 2017).

[b]Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan-a web and mobile app for systematic reviews. *Systematic Reviews, 5*(1), 210. doi:10.1186/s13643-016-0384-4

[c]Review Manager (Higgins & Green, 2011) is a Cochrane Collaborative computer program used to assess the study characteristics as well as the risk of bias and create the forest plots found in this analysis.

[c]Higgins, J. P. T., & Green, S. e. (2011). *Cochrane Handbook for Systematic Reviews of Interventions [updated March 2011]* (Version 5.1.0 ed.): The Cochrane Collaboration, 2011.

[d]The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram depicts the process in which literature is searched, screened, and eligibility criteria is applied (Moher, Liberati, Tetzlaff, & Altman, 2009).

[d]Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097 **For more information, visit www.prisma-statement.org.**

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Acronyms Used in this Document

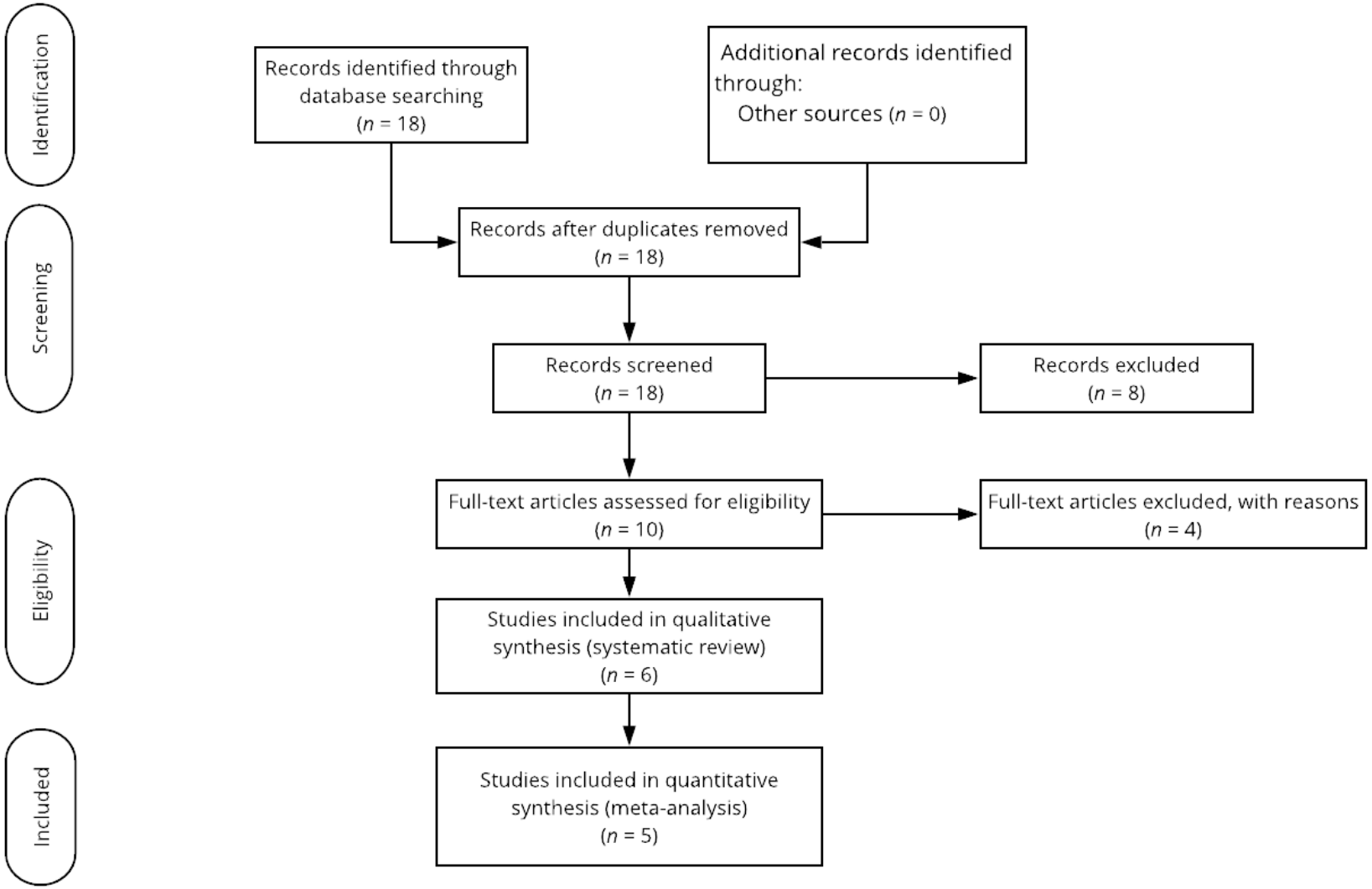
Acronym	Explanation
CAT	Critically Appraised Topic
EBP	Evidence Based Practice
ERAS	Enhance Recovery After Surgery
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
TAP	Transverse Abdominal Plane
VAS	Visual Analogue Scale

Statistical Acronyms Used in this Document

Statistical Acronym	Explanation
CI	Confidence Interval
I^2	Heterogeneity test
M or $\bar{X}$	Mean
MD	Mean Difference
n	Number of cases in a subsample
N	Total number in sample
OR	Odds Ratio
RCT	Randomized controlled trial
SD	Standard deviation
SR	Systematic Review

Figure 1

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRIMSA)[d]



Summary of Findings Table
Table 1

Summary of Findings Table[c]: TAP vs standard of care

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**TAP block**	**standard of care**	**Relative (95% CI)**	**Absolute (95% CI)**		
Opioid need 24hr post-op												
3	randomized trials	not serious	not serious	serious[a]	serious[b]	Strong association	13/189 (6.9%)	53/188 (28.2%)	**OR 0.14** (0.07 to 0.28)	**230 fewer per 1,000** (from 255 fewer to 183 fewer)	⊕⊕⊕◯ Moderate	IMPORTANT
Opioid need in first 24hrs post-op												
1	randomized trials	not serious	not serious	serious[a]	Serious[c]	none	27	30	-	MD **3.4 lower** (11.42 lower to 4.62 higher)	⊕◯◯◯ Very low	IMPORTANT
Pain 0 hr post op												
2	randomized trials	not serious	not serious	serious[a]	Serious[b]	none	7/77 (9.1%)	8/80 (10.0%)	**OR 0.92** (0.32 to 2.71)	**7 fewer per 1,000** (from 66 fewer to 131 more)	⊕⊕◯◯ Low	IMPORTANT

Pain 0 hr post-op RYGB												
1	observational studies	not serious	not serious	serious[a]	serious[b]	none	7/106 (6.6%)	5/147 (3.4%)	**OR 2.01** (0.62 to 6.51)	**32 more per 1,000** (from 13 fewer to 152 more)	⊕◯◯◯ Very low	IMPORTANT
Pain 24 hr post-op												
2	randomized trials	not serious	not serious	serious[a]	serious[b]	none	4/77 (5.2%)	4/80 (5.0%)	**OR 1.09** (0.28 to 4.31)	**4 more per 1,000** (from 35 fewer to 135 more)	⊕⊕◯◯ Low	IMPORTANT
Pain 24hr post-op RYGB												
1	observational studies	not serious	not serious	serious[a]	serious[b]	none	5/106 (4.7%)	5/147 (3.4%)	**OR 1.41** (0.40 to 4.98)	**13 more per 1,000** (from 20 fewer to 115 more)	⊕◯◯◯ Very low	IMPORTANT
Pain 24 hr post-op												
2	randomized trials	not serious	very serious[d]	serious[a]	not serious	none	139	138	-	MD **11.62 lower** (14.16 lower to 9.09 lower)	⊕◯◯◯ Very low	IMPORTANT

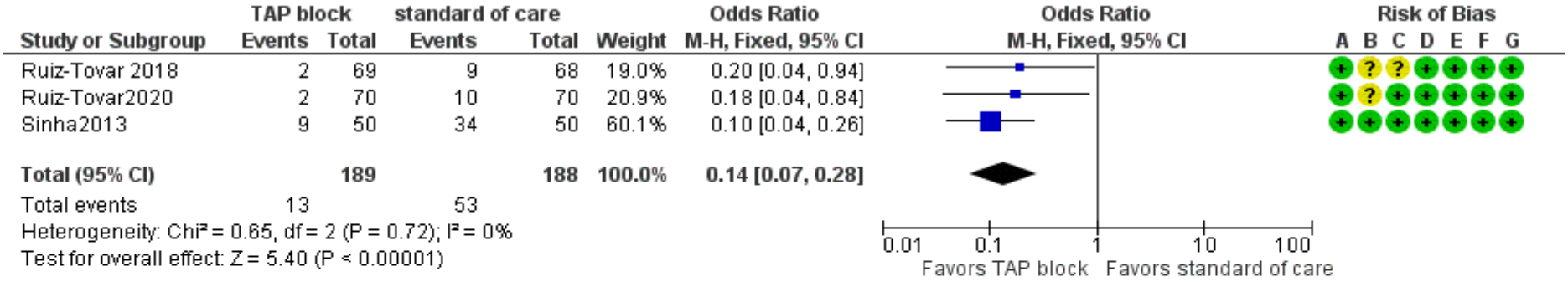
Notes

a. Adult population only
b. Low number of events and participants
c. Very small sample
d. Heterogeneity of 95%

Meta-analyses

Figure *2*

Comparison: TAP versus standard of care, Outcome: Opioid need in first 24hr post-op dichotomous data



Risk of bias legend
(**A**) Random sequence generation (selection bias)
(**B**) Allocation concealment (selection bias)
(**C**) Blinding of participants and personnel (performance bias)
(**D**) Blinding of outcome assessment (detection bias)
(**E**) Incomplete outcome data (attrition bias)
(**F**) Selective reporting (reporting bias)
(**G**) Other bias

Figure *3*

Comparison: TAP versus standard of care, Outcome: Opioid need in first 24hr post-op continuous data

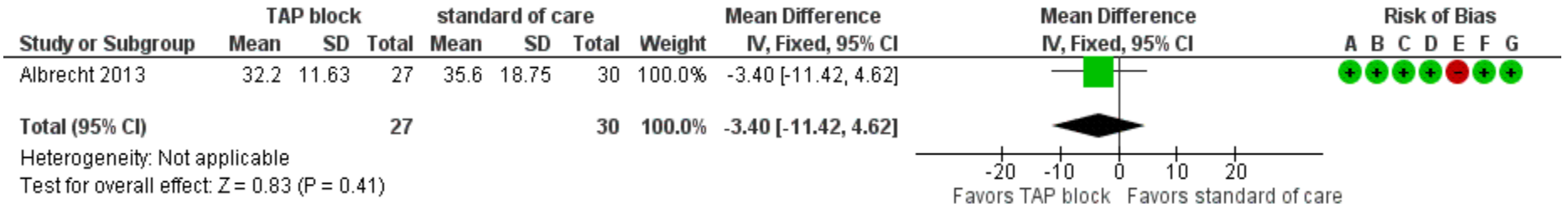
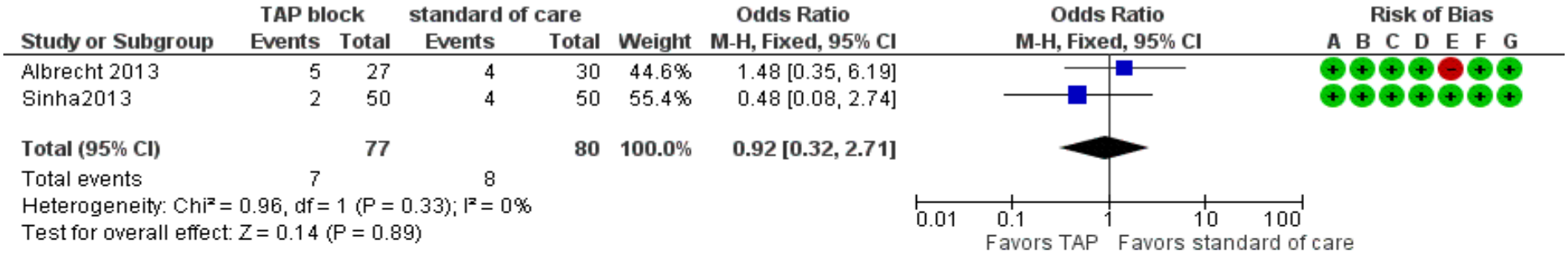


Figure *4*

Comparison: TAP versus standard of care, Outcome: Pain at 0 hours postop, RCT



Study or Subgroup	TAP block Events	Total	standard of care Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Albrecht 2013	5	27	4	30	44.6%	1.48 [0.35, 6.19]
Sinha2013	2	50	4	50	55.4%	0.48 [0.08, 2.74]
Total (95% CI)		**77**		**80**	**100.0%**	**0.92 [0.32, 2.71]**
Total events	7		8			

Heterogeneity: Chi² = 0.96, df = 1 (P = 0.33); I² = 0%

Test for overall effect: Z = 0.14 (P = 0.89)

Risk of bias legend

(**A**) Random sequence generation (selection bias)

(**B**) Allocation concealment (selection bias)

(**C**) Blinding of participants and personnel (performance bias)

(**D**) Blinding of outcome assessment (detection bias)

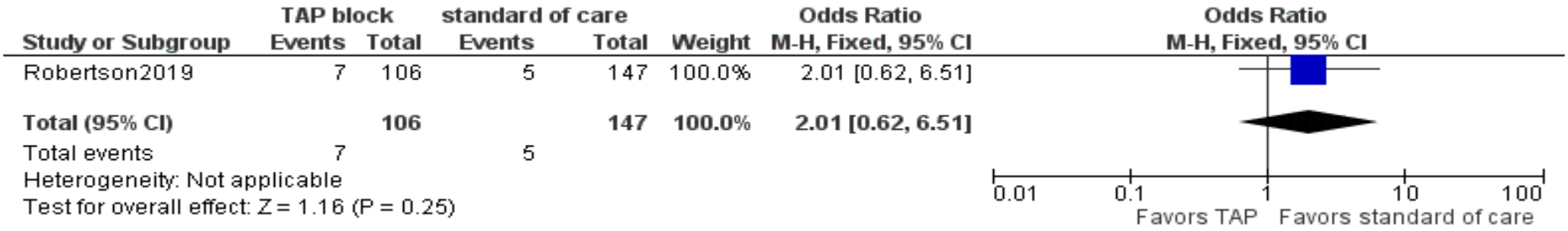
(**E**) Incomplete outcome data (attrition bias)

(**F**) Selective reporting (reporting bias)

(**G**) Other bias

Figure *5*

Comparison: TAP versus standard of care, Outcome: Pain at 0 hours postop, observational study



Study or Subgroup	TAP block Events	Total	standard of care Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Robertson2019	7	106	5	147	100.0%	2.01 [0.62, 6.51]
Total (95% CI)		**106**		**147**	**100.0%**	**2.01 [0.62, 6.51]**
Total events	7		5			

Heterogeneity: Not applicable

Test for overall effect: Z = 1.16 (P = 0.25)

Figure *6*

Comparison: TAP versus standard of care, Outcome: Pain at 24 hours postop, RCT, dichotomous data

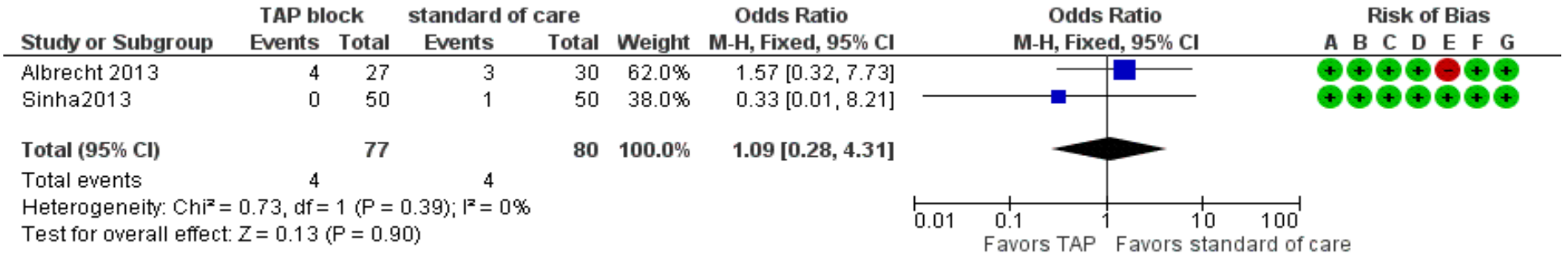


Figure *7*

Comparison: TAP versus standard of care, Outcome: Pain at 24 hours postop, observational study, dichotomous

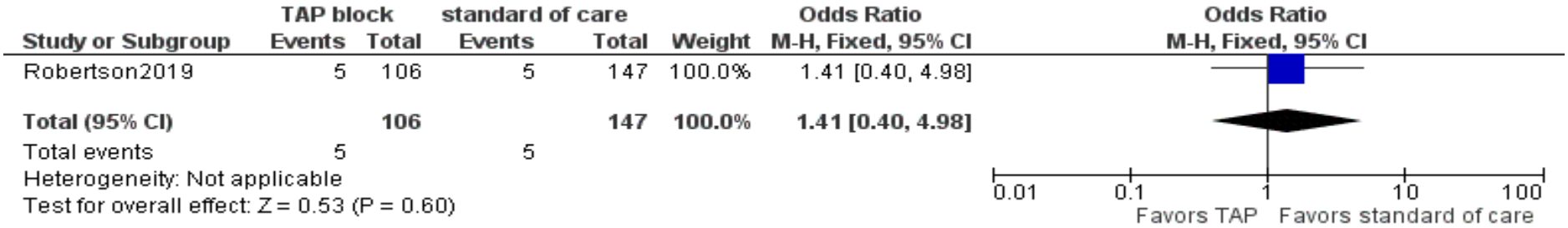
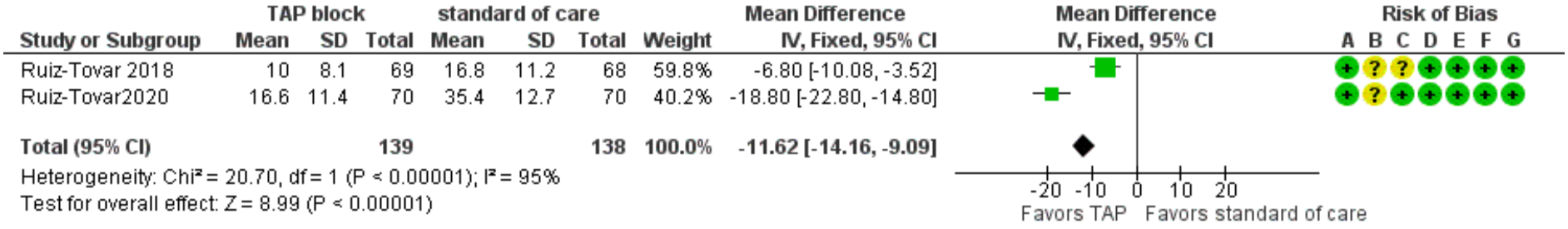


Figure *8*

Comparison: TAP versus standard of care, Outcome: Pain at 24 hours postop, RCT, continuous data



Characteristics of Intervention Studies

Albrecht, 2013

Methods	Randomized Control Trial
Participants	**Participants:** Patients undergoing laparoscopic gastric-bypass surgery (LGBS) between January 22, 2012, and June 18, 2012. **Setting:** Canada, Academic Medical Center (Toronto Western Hospital) **Randomized into study:** *N* = 70 • **Group 1, Bilateral transversus abdominis plane (TAP) Blocks:** *n* = 35 • **Group 2, No TAP Block:** *n* = 35 **Completed Study:** *N* = 57 • **Group 1:** *n* = 27 • **Group 2:** *n* = 30 **Gender, males (as defined by researchers):** • **Group 1:** *n* = 7 (25.9%) • **Group 2:** *n* = 4 (13.3%) **Race / ethnicity or nationality:** • The study occurred in 2013. The authors did not identify race or ethnicity of the participants. **Age, mean in years, (range)** • **Group 1:** 44.8 (40.8-48.8) • **Group 2:** 38.8 (34.9-42.8) **Inclusion Criteria:** • Age 18 to 70 years • American Society of Anesthesiologists physical status I-III **Exclusion Criteria:** • History of alcohol or drug abuse or dependency • History of chronic pain disorder or opioid intake • Contraindication to peripheral nerve block (e.g., allergy to local anesthetics, coagulopathy, infection in the area) **Power Analysis:** Assuming a 40% difference in opioid consumption during the first 24 hours between groups with an alpha error of 0.05 and a power of 80%, 28 patients would be required for each group (total 56).
Interventions	**Both groups:** Receive general anesthetic prior to surgery with weight adjusted dosing calculated on ideal body weight plus 30%. Before extubation, patients received ketorolac 30 mg IV, dexamethasone 8mg IV, and either granisetron 1mg IV or ondansetron 4mg IV. Each trocar site was infiltrated with 4-5 ml of 0.25% bupivacaine with 1:200,000 epinephrine (20 ml total) at end of operation. Postoperatively, pain management included incremental doses of fentanyl 25–50 µg IV and

	morphine 1–2 mg IV or hydromorphone 0.2–0.4 mg IV to achieve a clinical target of 4/10 or lower on a numeric rating scale (NRS). • **Group 1:** Ultrasound-guided TAP blocks of 30 ml 0.25% bupivacaine with 1:300,000 epinephrine injected in each side, utilizing oblique subcostal approach, prior to surgical incision. • **Group 2:** No pain block administered
Outcomes	**Primary outcome:** • Cumulative Opioid Consumption, first 24 hours postoperatively* **Secondary outcomes:** • Opioid consumption during phase I recovery and for 24-48 hours postoperatively* • Time to first analgesic request • Pain scores at rest and with movement* • Rates of nausea or vomiting and pruritis* **Safety outcome:** Occurrence of TAP block complications
Notes	No occurrence of TAP block complications

Risk of Bias

Bias	**Judgment**	**Support for judgment**
Random sequence generation (selection bias)	Low Risk	Patients providing written informed consent were randomly allocated on the day of surgery to either the experimental group (bilateral TAP blocks) or control group (no TAP blocks) using a computer-generated randomization table in aggregates of 10.
Allocation concealment (selection bias)	Low Risk	Assignments were concealed in a sealed opaque envelope.
Blinding of participants and personnel (performance bias)	Low Risk	Pain was treated as needed by blinded nursing staff (Phase I recovery nurses and ward nurses). Research assistants (personnel collecting pt. data) were also blinded to the intervention the pt. received.
Blinding of outcome assessment (detection bias)	Low Risk	Sham injection not performed on control group, however, the review authors judge that the outcome measurement is not likely to be influenced by this lack of blinding as pts were requested to rate their score on a numeric rating scale of 0-10. See blinding of personnel for staff blinding.
Incomplete outcome data (attrition bias)	High Risk	The researchers did not attain at least 28 participants in both study arms; therefore, the study was not powered sufficiently to detect a difference.
Selective reporting (reporting bias)	Low Risk	All outcomes are reported
Other bias	Low Risk	None reported

McCarthy, 2020

Methods	Cohort, retrospective
Participants	**Participants:** Adult patients who underwent laparoscopic bariatric surgery **Setting:** Rush Medical Center **Number enrolled into study:** *N* = 509 • **Group 1, TAP blocks in laparoscopic gastric bypass:** *n* = 94/144 • **Group 2, TAP blocks in laparoscopic sleeve gastrectomy:** *n* = 172/365 **Gender, males (as defined by researchers):** • **Group 1:** *n* = 15(16%) • **Group 2:** *n* = 37(21%) **Race / ethnicity or nationality (as defined by researchers):** • **Group 1:** White: 60; African American: 33; Asian: 1 • **Group 2:** White: 69; African American: 102; Asian: 1 **Age, mean (SD) in years:** • **Group 1:** 45.2 (11.3) -gastric bypass no TAP: 43.7 (11.5) • **Group 2:** 44.9 (11.2)-sleeve gastrectomy no TAP: 44.1 (10.7) **Inclusion Criteria:** • Patients undergoing laparoscopic bariatric surgery at Rush Medical Center between January 1, 2017, through December 31, 2018. **Covariates Identified:** • Obstructive sleep apnea • Hx of depression or anxiety
Interventions	**Both:** • TAP block placed bilaterally using a subcostal approach preoperatively with ultrasound guidance. TAP technique varied by anesthesiologist, but standard method used did not advance the needle in the facial plane. • Pain assessment completed by nursing every 15 minutes once in the PACU and every 4 hours from PACU discharge to discharge home • Opioid analgesics administered from surgery to d/c. ○ **Group 1:** Initiated TAP blocks in gastric bypass patients in second quarter of 2017 ○ **Group 2:** Initiated TAP blocks in gastric sleeve patients in third quarter of 2017
Outcomes	**Primary outcome(s):** • *Total amount of opioid analgesics administered during hospital stay **Secondary outcome(s):** • Number of antiemetic medication doses received (nausea/vomiting) • LOS **Safety outcome(s):** • Due to length of surgery, opioid consumption totals reported out separately between groups. *Outcomes of interest to the CMH CPM development team

Results

Results:

- TAP blocks performed in 65% of gastric bypass patients and 47% of gastric sleeve patients
- Gastric bypass and sleeve gastrectomy patients with TAP procedure had a shorter surgery time and received less pain medication intraoperatively than patients without TAP procedure
- TAP patients noted to have an increased number with Obstructive Sleep Apnea (OSA)
- Total opioids given or provided on request postoperatively were less for the TAP groups
- Antiemetic medications received were also lower in the TAP groups

McCarthy2020	TAP	No-TAP	Difference (95% CI), P-value
Median opioid analgesia (IQR) mg morphine equivalents (oral)	17 (142-201)	211 (163-261)	-40 (-10 to -65), < 0.01

Limitations:

- Single retrospective study
- Analysis of clinical use was based on provider preference
- No comparison of end range complications was completed
- Utilized anterior subcostal approach for TAP blocks vs. posterior axillary line which may have impacted the ability to block the anterior and posterior branches of the intercostal nerves.
- Data provided in IQR; unable to add to meta-analysis

Unknown confounders may not have been captured in study design

Robertson, 2019

Methods	Cohort, retrospective
Participants	**Participants:** A single surgeon's consecutive series of Roux-En-Y gastric bypass (RYGB) and Laparoscopic sleeve gastrectomy (LSG) patients, 2010-2016 **Setting:** USA, hospital **Number enrolled into study:** *N* = 1328, of which 440 were randomly selected for further analysis • **Group 1a (RYGB + Patient controlled analgesia (PCA) pump):** *n* = 147 • **Group 1b (LSG + PCA):** *n* = 82 • **Group 2a (RYGB + Transvers abdominis plane (TAP) block + opioids):** *n* = 106 • **Group 2b (LSG + TAP block + opioids):** *n* = 105 **Gender, males, %** • **Group 1a**: 20 • **Group 1b**: 17 • **Group 2a**: 18 • **Group 2b**: 15 **Race / ethnicity or nationality (as defined by researchers), %:** • **Group 1a:** ○ Caucasian: 60.5 ○ African American: 36.7 ○ Hispanic: 2.7 ○ Other: 0 • **Group 1b:** ○ Caucasian: 57.3 ○ African American: 40.2 ○ Hispanic: 0 ○ Other: 2.4 • **Group 2a:** ○ Caucasian: 59.4 ○ African American: 37.7 ○ Hispanic: 0 ○ Other: 2.8 • **Group 2b:** ○ Caucasian: 56.2 ○ African American: 41.0 ○ Hispanic:1.9 ○ Other: 0.9 **Age, mean in years** • **Group 1a**: 48.2 +/- 1.0 • **Group 1b**: 45.3 +/- 1.0

	• **Group 2a**: 49.0 +/- 1.0 • **Group 2b**: 47 +/- 1.1 **Inclusion Criteria:** • None listed, this was a retrospective group randomly selected from one surgeon's surgical patient group **Exclusion Criteria:** • None listed, this was a retrospective group randomly selected from one surgeon's surgical patient group **Covariates Identified:** No covariates identified
Interventions	• **Group 1a**: RYGB + PCA pump: • **Group 1b**: LSG + PCA pump • **Group 2a**: RYGB + TAP block + opioids • **Group 2b**: LSG + TAP block + opioids
Outcomes	**Primary outcome(s):** • Use of parenteral morphine equivalents **Secondary outcome(s):** • LOS • *Post-op pain scores *Outcomes of interest to the CMH CPM development team
Results	**Results:** • The bottom-line conclusion to the study was that the use of a TAP block may be a useful method to provide an adjunct to postop pain control, as it is associated with decreased total morphine equivalent use and decreased LOS. However, it did not demonstrate a decrease in postop pain scores. **Limitations:** • The TAP group was a significantly younger group of patients

Ruiz-Tovar, 2018

Methods	Randomized Control Trial
Participants	**Participants:** Patients undergoing Roux-en-Y gastric bypass (RYGB) between March-December 2017. **Setting:** Spain **Randomized into study:** *N* = 140 • **Group 1, Transversus abdominis plane (TAP):** *n* = 70 • **Group 2, Post site infiltration (PSI):** *n* = 70 **Completed Study:** *N* = 137 • **Group 1:** *n* = 69 • **Group 2**: *n* = 68 **Gender, males (as defined by researchers):** *n* = 60 (42.9 %) • **Group 1:** *n* = 30 (43.4 %) • **Group 2:** *n* = 30 (44.1 %) **Race / ethnicity or nationality (as defined by researchers):** • Not reported **Age, mean in years:** 41.8 + 7.3 years • **Group 1:** *n* = 41.9 + 5.9 years • **Group 2:** *n* = 41.7 + 7.2 years **Inclusion Criteria:** • Body mass index (BMI) > 40 kg/m2 • BMI > 35 kg/m2 with the presence of comorbidities associated to obesity **Exclusion Criteria**: • Patients undergoing other bariatric techniques • Severe under-lying cardiovascular diseases • Chronic renal failure • Hepatic dysfunction • Previous foregut surgery • Patients with any contraindication for bariatric surgery • Patients presenting postoperative complications were excluded from the final analysis **Power Analysis:** • Not reported

Interventions	**Both:** 6 cm long gastric pouch preformed and closed in same manner, intravenous analgesia metamizole 2g/8hr and acetaminophen 1g/8hr; alternating every 4 hours • **Group 1:** 30 mL of bupivacaine 0.25% injected into the plane between the internal oblique and the transverse abdominis muscles • **Group 2:** 30 mL of bupivacaine 0.25% under aponeurotic layer in each of 5 ports placed.
Outcomes	**Primary outcome(s):** • Post-op pain levels* • Opioid consumption* • Length of stay* **Secondary outcome(s):** • Operation time *Outcomes of interest for the CPM team
Notes	• Morphine rescues = 32% PSI and 2.9% in TAP-lap • Operation time TAP = 83.3 + 15.6 min • Operation time PSI = 80.5 14.4 min • VAS mild pain range is 5-44 mm

Risk of Bias

Bias	**Judgment**	**Support for judgment**
Random sequence generation (selection bias)	Low Risk	A computerized simple randomization scheme was used
Allocation concealment (selection bias)	Unclear Risk	Insufficient information to permit judgment of low or high risk
Blinding of participants and personnel (performance bias)	Unclear Risk	There is no mention of blinding but insufficient evidence to determine if patients knew what treatment they were receiving prior to sedation
Blinding of outcome assessment (detection bias)	Low Risk	Blinding of outcome assessment ensured; nurse performing pain assessment post-op blinded to treatment applied.
Incomplete outcome data (attrition bias)	Low Risk	Patients presenting with post-operative complications were excluded from final analysis but not enough to have a clinically relevant impact on effect size
Selective reporting (reporting bias)	Low Risk	All outcomes reported
Other bias	Low Risk	Reported out on compliance with ethical standards

Ruiz-Tovar, 2020

Methods	Randomized Control Trial, prospective clinical trial
Participants	**Participants:** **Setting:** Spain, International Federation for Surgery of Obesity Center of Excellence, December 2018 - March 2019 **Randomized into Study:** *N* = 140 • **Group 1, Patients undergoing postoperative laparoscopic guided Transverse abdominal plane (TAP):** *n* = 70 • **Group 2**, **Standard of care (SOC):** *n* = 70 **Gender, males (%)** • **Group 1**: 29 • **Group 2**: 29 **Race/ethnicity (as defined by researchers):** Not specified **Age, years** • **Group 1**: 43.1 +/- 10.6 • **Group 2**: 43.9 +/- 10.2 **Inclusion Criteria:** • Adult patients scheduled for one-anastomosis gastric bypass (OAGB) surgery • BMI >40, or >35 with presence of co-morbidities associated with obesity **Exclusion Criteria:** • Patients scheduled for additional surgeries (band removal, cholecystectomy, hernioplasty, or hiatal hernia treatment • History of foregut surgery, bariatric revision surgery, or allergy to local anesthetics, coagulopathy, or anticoagulation • Patients who refused TAP block **Power Analysis:** 70 patients required for each group **Covariates Identified:** Patients who reported postoperative pain > VAS score of 50+mm received a rescue dose of morphine

Interventions	Both groups were patients undergoing one-anastomosis gastric bypass surgery that included a preoperative port site infiltration with 10ml of bupivacaine 0.25%1.5ml in each of 6 ports
	• **Group 1:** Treatment included a laparoscopic post-operative TAP block as part of a multi modal analgesic regimen:
	  ○ 1g/6h acetaminophen
	  ○ Bupivacaine 0.25% 30 ml, injected into the plane between the internal oblique and the transversus abdominis muscles
	  ○ Intravenous analgesia
	• **Group 2:** Treatment did not include a laparoscopic postop TAP block
	  ○ Intravenous analgesia only (SOC)

Outcomes	**Primary Outcomes:** • *Postop pain levels at 24 hours **Secondary outcomes:** • Postop pain levels at 6 hours • Surgical duration • *Opioid consumption during first 24 hours postop • Prophylaxis of nauseas and vomiting • Complications • Length of stay (LOS) *Outcomes of interest for the CPM team
Notes	• **Outcome: Pain levels post-op** Pain scale referenced is a Visual Analog Scale (VAS), ranging from 0 mm (absence of pain) to 100 mm (unbearable pain) • **Outcome: Opioid consumption.** Listed as a study variable but not reported. Authors do report that morphine "rescues" (5 mg, subcutaneous) were necessary in 2 of the TAP group and 10 of the SOC group • **Outcome: LOS.** Median hospital stay was 1 day (range 1-2 days in both groups. Hospital discharge during the first 24 hours was 95.7% of TAP group and 87.1 of the SOC group.

Risk of Bias

Bias	**Judgment**	**Support for judgment**
Random sequence generation (selection bias)	Low Risk	Patients randomized using a computerized simple randomization scheme
Allocation concealment (selection bias)	Unclear Risk	Not specified
Blinding of participants and personnel (performance bias)	Low Risk	Did not blind providers as to whether a patient received a TAP block or not. However, unlikely to have an impact on outcome assessment as this was completed by blinded personnel
Blinding of outcome assessment (detection bias)	Low Risk	Completed by nurse blinded to treatment and control group allocation
Incomplete outcome data (attrition bias)	Low Risk	All patients enrolled were used in data analysis
Selective reporting (reporting bias)	Low Risk	All outcomes reported
Other bias	Low Risk	Provide disclosures of no conflict of interest and no financial ties

Sinha, 2013

Methods	Randomized Control Trial
Participants	**Participants:** Patients with BMI > 35kg/m^2 scheduled for laparoscopic gastric bypass surgery **Setting:** Speciality hospital in New Delhi, India **Randomized into study:** *N* = 100 • **Group 1, Ropivacaine TAP (RT):** *n* = 50 • **Group 2, no TAP (NT):** *n* = 50 **Completed Study:** *N* = 100 • **Group 1:** *n* = 50 • **Group 2:** *n* = 50 **Gender, males (as defined by researchers):** • Not reported for either group **Race / ethnicity or nationality (as defined by researchers):** • Not reported for either group **Age, mean in years, ± SD** • **Group 1:** 39.1 ± 10.6 • **Group 2:** 39.9 ± 13.3 **Inclusion Criteria:** • BMI > 35 kg/m^2 • Either sex • Age of more than 18 years • Scheduled for laparoscopic gastric bypass **Power Analysis:** Calculation of a minimum of 45 subjects per group was needed for a power of 90 at 1% level of significance
Interventions	**Both:** At the conclusion of surgery, patients were placed in a 15° tilt away from the side the block was performed, and an assistant positioned the patient's abdomen to the opposite side of the block. This was then repeated when the injection/block was completed for the opposite side. • **Group 1:** bilateral TAP block of ropivacaine • **Group 2**: bilateral injection of normal saline
Outcomes	**Primary outcome(s):** • *Requirement of Tramazac hydrochloride in first 24 hours after surgery **Secondary outcome(s)** • Visual analogue scale (VAS) score using the Richmond Agitation Sedation Scale

	• Time to ambulation • Any adverse events **Safety outcome(s):** • None mentioned *Outcomes of interest to the CMH CPM development team

Notes	• Limitations reported include:
	  ○ A large number of assistants were required to complete the procedure per the protocol
	  ○ Length of hospital stay was not evaluated as determined this outcome could be impacted by surgical obstacles vs. the TAP block alone so was not considered in the analysis

Risk of Bias

Bias	**Judgment**	**Support for judgment**
Random sequence generation (selection bias)	Low Risk	Computer generated allocation schedule used.
Allocation concealment (selection bias)	Low Risk	Each study participant was allocated a unique randomization number generated by the computer program. The number was sent to the investigator who determined the treatment according to the randomization code. Informed consent acquired prior to assigning a randomization code
Blinding of participants and personnel (performance bias)	Low Risk	Anesthesiologists, independent of the study, assessed patient eligibility, obtained the randomization number and allocation of treatment group.
Blinding of outcome assessment (detection bias)	Low Risk	The researchers did not receive the codes or group assignments until randomization, data collection and analysis were completed.
Incomplete outcome data (attrition bias)	Low Risk	All patients enrolled had their data analyzed.
Selective reporting (reporting bias)	Low Risk	All pre-specified outcomes were reported in results section
Other bias	Low Risk	Authors declared no conflicts of interest

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**References marked with an asterisk indicate studies included the meta-analysis.*

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