AVANOS

CLINICAL COMPENDIUM

OPIOID REDUCTION STUDIES

ON-Q*
PAIN RELIEF SYSTEM

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AVANOS

#	STUDY	LOE	DESIGN	DEVICE/PROCEDURE	CONCLUSION	
					SAFETY	PERFORMANCE
1	**Evaluation of novel local anesthetic wound infiltration techniques for postoperative pain following colorectal resection surgery: a meta-analysis** Ventham NT, et al. Disease of the Colon and Rectum 2014 Feb; 57(2): 237-50. MD. Department of Colorectal Surgery, Western General Hospital - Edinburgh, UK *https://pubmed.ncbi.nlm.nih.gov/24401887*	I	Meta-analysis RCTs Included 12 studies 878 patients	Multiple, including ON-Q Colorectal Open or laparoscopic	• No difference in wound healing or surgical complications between the groups	Local anesthetic techniques compared to placebo/routine techniques showed: • Significant reduction in opiate requirement at 48 hrs (P=.002) • Lower pain scores on movement at 24 and 48 hrs in studies where catheter was placed subfascial (P=.02, P=.004) • Significant reduction in length of stay (P=.02) • Significant improvement in return of bowel function
2	**Local delivery of bupivacaine in the wound reduces opioid requirements after intraabdominal surgery in children** Hermansson O et al. Pediatr Surg Int 2013; 29: 451-4. Pediatric Surgery, University Children's Hospital – Uppsala, Sweden *https://pubmed.ncbi.nlm.nih.gov/23483343*	I	RCT Double-blind, placebo controlled 33 children (6 months-13 y/o) bupivacaine dosing: <9 kg (0.2 mg/kg/h) >9 kg (0.4 mg/kg/h) 100-250 mL at 1-2 mL/hr	ON-Q with soaker catheters Enterostomy closure, open gastrostomy or ureteral reimplantation	• One catheter was accidentally cut during wound dressing change in the saline group; Pt excluded	• PTs in bupivacaine group used significantly less morphine on POD 1 and Cumulative (P<.05) • NS on POD 1 and 2 • No difference between groups for time to full oral intake or time to discharge
3	**Postoperative pain after abdominal hysterectomy: a randomized, double-blind, controlled trial comparing continuous infusion vs. patient-controlled intraperitoneal injection of local anaesthetic** Pernola A et al. B J Anaesth 2014; 112: 328-336. Department of Anesthesiology and Intensive Care, University Hospital - Orebro, Sweden *https://pubmed.ncbi.nlm.nih.gov/24185607*	I	RCT, blinded 40 Pts levobupivacaine .125% Normal Saline control	ON-Q and Electronic PCA TAH 2 catheters placed	• No difference in PONV, sedation of health-related quality of life scores between groups • No major complications, including infection • No S/S of LA toxicity	LA PCA group compared with CI PCA group: • Less use of rescue analgesics during 0-4 hr post-op (P=.015) and 0-24 hr (P=.021) • No difference in rescue analgesic 24-48 hrs • Used significantly less levobupivacaine after 24 hrs 180 mL vs. 240 mL (P<.01) • Quicker return to GI function 1.5 vs. 2.2 days (P<.01)
4	**The 2012 Chitranjan Ranawaat Award: Intraarticular analgesia after TKA reduces pain: a randomized double-blinded, placebo-controlled, prospective study** Goyal N et al. Clin Orthop Relat Res 2013; 471: 64-75. Surgeon, Anderson Orthopedic Clinic – Alexandria, VA *https://pubmed.ncbi.nlm.nih.gov/23011843*	I	RCT 150 Pts	ON-Q TKA	• No difference in adverse events between groups	ON-Q group: • 33% less narcotic use on POD 2 (P=.021) and 54% reduction on POD 3 (P=.038) • Trend toward lower pain scores throughout POD 2 • Significant difference in all pain scores on POD 1 (P=.03) • Significant difference in highest pain scores on POD 2 (P=.04) • No difference in LOS or narcotic side effects • Pts reported lower VAS score during hospitalization when asked about their postoperative pain at 4-week f/u visit

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5	**The analgesic effects of a bilateral sternal infusion of ropivacaine after cardiac surgery** Eljezi V et al. Reg Anesth Pain Med 2012; 37: 166-174. Surgeon, University Clermont - Clermont-Ferrand, France *https://pubmed.ncbi.nlm.nih.gov/22266899*	I	RCT 40 Pts	ON-Q Dual site Sternotomy	• Serum ropivacaine levels measured with a trend toward increasing concentrations with time (0.2% ropivacaine, 2 mL/hr, dual site) • Serum level >4mg/L in one patient. No symptoms of toxicity reported • No major adverse events due to treatment	Treatment group: • Morphine use less, 20 mg vs. 30 mg (P=.036) • Lower VAS scores at mobilization (P=.0004) and at rest (P=.0006) • Most significant on POD 2 with 41% reporting a reduction in pain on movement • Improved patient satisfaction (P<.0001) • Quality of rehab improved • No difference in respiratory function
6	**The analgesic efficacy of continuous wound instillation with ropivacaine after open hepatic surgery** Chan SK et al. Anesthesia 2010; 65: 1180-1186. Anesthesiologist, Prince of Wales Hospital/Chinese University – Hong Kong, China *https://pubmed.ncbi.nlm.nih.gov/20958277*	I	RCT 48 Pts	ON-Q Hepatic Surgery	• Ropivacaine serum levels gradually increased (mean of 2.5 mcg/mL) • No clinical evidence of toxicity • Authors concluded that ropivacaine conc should be no greater than 0.25% for patients after hepatic resection	Treatment group: • Morphine consumption less, 58 mg vs. 86 mg (P<.01) • Less pain up to 72 h (P<.01) • Less reduction in lung vital capacity • No difference in LOS, ICU stay or extubation time between groups
7	**Continuous Preperitoneal infusion of ropivacaine provides effective analgesia and accelerates recovery after colorectal surgery** Beaussier et al. Anesthesiology 2007; 107: 461-468. Anesthesiologist, St. Antoine Hospital – Paris, France *https://pubmed.ncbi.nlm.nih.gov/17721249*	I	RCT 42 Pts	ON-Q Colon surgery	• No adverse events in either group • No systemic local anesthetic toxicity	Treatment group: • Morphine significantly less over all 3 days (P=.0004) • Decrease in pain intensity at rest and coughing (P<.01) • Quality of sleep rated better in x 2 postoperative nights • Recovery of bowel function faster (P=.02) • Decreased LOS (P=.02)
8	**Use of the ON-Q pain management system is associated with decreased postoperative analgesic requirement: double blind randomized placebo pilot study** Baig et al. J Am Coll Surg 2006; 202: 297-305. Surgeon, Cleveland Clinic Florida – Weston, FL *https://pubmed.ncbi.nlm.nih.gov/16427556*	I	RCT 70 Pts	ON-Q Colectomy	• No difference in PONV • 30-day f/u to assess for complications: wound infection rate of 2.9% in each group compared with 7.26% rate reported by CDC for same surgery	Treatment group: • Significant less narcotic requirements (P<.04) • NS difference in pain scores • Earlier ambulation (P=.033) • Earlier return of bowel function, but NS • No difference in LOS
9	**Effectiveness of continuous wound infusion of 0.5% ropivacaine by ON-Q pain relief system for postoperative pain management after open nephrectomy** Forastiere E et al. British Journal of Anaesthesia 2008; 101(6): 841-7. Anesthesiologist, National Cancer Institute of Rome – Rome, Italy *https://pubmed.ncbi.nlm.nih.gov/19004914*	I	RCT 168 Pts	ON-Q Open Nephrectomy	• Decreased sedation scores in ON-Q group	Study group: • Lower pain scores (P<.0001–.001) • Mean morphine consumption 47% lower in ON-Q group P<.001) • PONV lower • Earlier return of bowel activity (P<.001) • Decreased LOS (1 day less, P<.001) • Mean cost of care 34% lower

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10	**A randomized trial of postoperative wound irrigation with local anesthetic for pain after cesarean delivery** Givens V et al. Am J Obset Gynecol 2002; 186: 1188-1191. Surgeon, University of Tennessee Health Science Center – Memphis, TN *https://pubmed.ncbi.nlm.nih.gov/12066096*	I	RCT 36 Pts	ON-Q Cesarean Section	• 1 wound cellulitis	Treatment group: • Significant reduction in narcotic usage 43% (P<.01) • No significant difference in pain scores
11	**Postoperative analgesia in TKA: ropivacaine continuous intra-articular infusion** Gomez-Cardero et al. Clin Orthop Relat Res 2010; Jan 5 [epump ahead of print] Surgeon, La Paz University – Madrid, Spain *https://pubmed.ncbi.nlm.nih.gov/20049572*	I	RCT 50 Pts	ON-Q TKA	• No wound complications or infections due to device • No adverse effects from ropivacaine	Study group: • Lower pain scores x 3 days (P<.001) • Less opioid consumption (P<.004) • 1.5 day reduction in LOS (P<.001) • No difference in joint ROM throughout study period and up to 1 month
12	**Continuous wound infiltration with ropivacaine reduces pain and analgesic requirement after shoulder surgery** Gottschalk et al. Anesth Analg 2003; 97: 1086-1091. Anesthesiologist , University Hospital Eppendorf – Hamburg, Germany *https://pubmed.ncbi.nlm.nih.gov/14500162*	I	RCT 45 Pts	ON-Q Shoulder	• No clinical symptoms of local anesthetic toxicity • Unbound serum ropivacaine levels below toxic threshold for 48 hrs • No wound healing problems or infections	• Significant reduction in narcotic use (P<.05) • Decrease in VAS at rest (P<.005)
13	**Prospective, randomized double-blind intravenous narcotic patient-controlled anesthesia pump for pain management after free TRAM flap breast reconstruction** Heller L et al. Plast. Reconstr Surg 2008; 122(4): 1010-18. Surgeon, University of Texas MD Anderson Cancer Center – Houston, TX *https://pubmed.ncbi.nlm.nih.gov/18827631*	I	RCT 69 Pts	ON-Q TRAM Flap Breast Reconstruction	• No infections • No local anesthetic toxicity	Treatment group: • Mean PCA narcotic use 40% less POD 1 and 55% less POD 2 (P=.019) • Mean total narcotic use 27% lower, NS • 3.6 times more likely to rate satisfaction as "very satisfied"
14	**Use of a continuous local anesthetic infusion for pain management after median sternotomy** White P, et al. Anesthesiology 2003; 99: 918-923. Anesthesiologist, University of TX Southwestern Medical Center – Dallas, TX *https://pubmed.ncbi.nlm.nih.gov/14508326*	I	RCT Dose response 24 Pts Normal Saline bupivacaine 0.25% bupivacaine 0.5%	ON-Q CABG via Median Sternotomy	Study group: • Serum bupivacaine level at <30% toxicity • Urinary catheter removal 1 day earlier (0.5% Group) • No wound infections • No adverse events	Study group (.05%): • 63% reduction in opioid (P<.05) • Ambulation was 12 hrs earlier (P<.05) • 1 day earlier return to normal diet (P<.05)

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15	**The use of continuous popliteal sciatic nerve block after surgery involving the foot and ankle: does it improve the quality of recovery?** White P et al. Anesth Analg 2003; 97: 1303-9. Anesthesiologist, University of TX Southwestern Medical Center – Dallas, TX *https://pubmed.ncbi.nlm.nih.gov/14570643*	I	RCT 20 Pts	ON-Q CPNB (foot/ankle surgery)	Study group: • Pts report increase in tingling of extremity; did not interfere with ambulation	Study group: • Required 70% less PCA morphine than control (P<.05) • Shorter LOS versus control group (0.7 ± 0.7 days versus 1.4 ± 0.5 days; P<.05) • Higher patient satisfaction than control (P<.05) • Higher quality of recovery • Decrease in VAS on POD 1 (P<.05)
16	**Continuous peripheral nerve block compared with single-injection peripheral nerve block. A systematic review and meta-analysis of randomized controlled trials** Bingham A et al. Regional Anesth and Pain Medicine 2012; 37: 583-594. Anesthesiologist, Columbia University - New York, NY *https://pubmed.ncbi.nlm.nih.gov/23080349*	I	Meta-analysis RCTs Included 21 studies 712 Pts	Not specified CPNB (orthopedic and breast)	• CPNB patients had significantly less PONV • Other complications not reported to enable evaluation	Compared with single shot nerve blocks, CPNB: • Improved pain control on POD 1 (P<.001) • Improved pain control on POD 2 (P<.001) • Decreased overall opioid use (P<.001) • Higher patient satisfaction scores (P<.001) • Unable to compare long-term functional outcomes
17	**Continuous interscalene infusion and single injection using levobupivacaine for analgesia after surgery of the shoulder** Kean J et al. J Bone Joint Surg [Br] 2006; 88: 1173-1177. Surgeon, Ninewells Hospital and Medical School – Dundee, Scotland *https://pubmed.ncbi.nlm.nih.gov/16943467*	I	RCT 16 Pts	ON-Q Shoulder	• No complications in either group • No neurological complications reported at 6 weeks	ON-Q group: • Lower VAS; only significant at 12 hrs (P=.02) • Less narcotic use, only significant at 24 hrs
18	**Interscalene brachial plexus block with a continuous catheter insertion system and a disposable pump** Klein S et al. Anesth Analg 2000; 91: 1473-1478. Anesthesiologist, Duke University Medical Center – Raleigh Durham, NC *https://pubmed.ncbi.nlm.nih.gov/11094003*	I	RCT 40 Pts	ON-Q CPNB (shoulder)	• Mean serum ropivacaine levels remained low after 24 hours	Treatment group: • Less morphine consumption than control (P<.004) • Lower pain scores (P=.0007)
19	**Local anesthetic infusion pumps improve postoperative pain after inguinal hernia repair: a randomized trial** Leblanc K et al. Am Surg 2004; 70: 1002-1006. Surgeon, Surgical Specialty Group – Baton Rouge, LA *https://pubmed.ncbi.nlm.nih.gov/15586515*	I	RCT 52 Pts	ON-Q Inguinal Hernia Repair	• No leakage around the catheter • No wound complications	• 24% of the bupivacaine group required no narcotics vs. 4% of the saline group (P<.05) • Significantly less narcotic use continued for 5 days after pump discontinued at 2 days

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20	**Efficacy of continuous wound catheters delivering local anesthetic for postoperative analgesia: a quantitative and qualitative systematic review of randomized controlled trials** Liu J et al. J Am Coll Sur 2006; 23 (6): 914-932. Anesthesiologist, Weil College of Medicine, Cornell University – New York, NY ***https://pubmed.ncbi.nlm.nih.gov/17116561***	I	Meta-analysis 44 RCT 2,141 Pts	Not specified Cardiothoracic, general, orthopedics, gynecology, urology	• No local anesthetic toxicity • Infection rates 0.7% in active group and 1.2% in control group • Less PONV in all groups combined (P<.001)	• Lower pain scores at rest in all groups combined (P<.001) and all subgroups (P<.001 to P=.02) • Fewer Pts required opioid rescue medication in all groups combined (P<.001) • Less total opioid required in all groups and all subgroups except orthopedics (P<.001) • Better patient satisfaction in all groups combined (P<.007) • LOS savings of 1 hospital day overall
21	**Continuous incisional infusion of local anesthetic in pediatric patients following open heart surgery** Tirotta C et al. Pediatric Anesthesia 2009; 19: 571-576. Anesthesiologist, Miami Children's Hospital – Miami, FL ***https://pubmed.ncbi.nlm.nih.gov/19645974***	I	RCT 72 pediatric Pts	ON-Q Open Heart via Median Sternotomy	Study group: • No wound infections or difference in wound healing • No pump malfunctions or disconnections • No S/S of local anesthetic toxicity • Plasma levels of local anesthetics below toxic threshold • Less antiemetic required in Pts weighing > 31 kg (P=.04)	Treatment group: • Total morphine requirements 75% less at 24 hrs (P=.007); NS difference POD 2 and 3 • Time to first bowel movement 1 day earlier (2.8 days vs. 3.7 days; P=.006) • No difference in pain scores between groups • No difference in time to first oral intake or urinary catheter removal
22	**Continuous popliteal sciatic nerve block versus single injection nerve block for ankle fracture surgery: a prospective randomized comparative trial** Ding DY et al. J Orthop Trauma 2015; 29(9): 393-398. MD. Department of Orthopaedic Surgery, New York University School of Medicine - New York, NY ***https://pubmed.ncbi.nlm.nih.gov/26165259***	II	RCT Double blinded until day of surgery 44 Pts • 23 received a sciatic single shot block (SSB) plus continuous block with ropivacaine 0.2% at 8 mL/hr • 21 received SSB only	ON-Q ORIF (unstable ankle fractures)	• ON-Q group: • 5 pts experienced dislodged catheters • 1 Pt reported the pump did not flow for the first 12 hrs • 1 Pt discontinued his catheter at 24 hrs • 1 pump stopped functioning shortly after discharge from PACU • No adverse side effects in ON-Q group	• Average amount of opioid required in PACU was lower in ON-Q group. (P=.041) • ON-Q group took significantly less oral pain meds during first 72 hrs (P=.036) • Pts in the ON-Q group reported lower VAS pain scores 2 weeks and 12 weeks after surgery (P=.014 and .004)
23	**Comparison between systemic analgesia, continuous wound catheter analgesia and continuous thoracic paravertebral block: a randomized, controlled trial of postthoracotomy pain management** Fortier S et al. Eur J Anaesthesiol 2012; 29: 524-30. MD. Department of Anaesthesia. Polyclinique duval de Saone - Macon, France ***https://pubmed.ncbi.nlm.nih.gov/22914044***	II	RCT 140 Pts • 50 received PCA morphine only • 44 received thoracic paravertebral block (TPVB) • 46 received continuous wound catheter infusion (CWC)	ON-Q Dual catheters for CWC group Thoracotomy	• No signs of toxicity or local complications observed	• VAS scores at rest were significantly better in the TPVB group compared to PCA at 0, 1, 3, and 6 hrs. (P<.0026) • VAS scores at rest were significantly better in the TPVB group compared to PCA after coughing at 0, 1, 3, 6 and 12 hrs. (P<.003) • Morphine use was significantly less in recovery room in the TPVB group, and at 24 hrs. (P=.00001; PP=.0036) • There was no difference between CWC and PCA groups in VAS scores or morphine consumption

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24	**A randomized trial of bupivacaine pain pumps to eliminate the need for patient controlled analgesia pumps in primary laparoscopic Roux-en-Y gastric bypass** Cottam D et al. Obesity Surgery 2007; 17: 595-600. Surgeon, Surgical Weight Control Center – Las Vegas, NV *https://pubmed.ncbi.nlm.nih.gov/17658017*	II	RCT 40 Pts	ON-Q Laparoscopic Roux-en-Y	• Not assessed	• Significant decrease in narcotic use from PACU to 0:600 in ON-Q group (129 mg ON-Q vs 217 mg PCA, P=.008) • No difference in PONV or pain scores between groups • Study ended after 18 hrs
25	**Assessment of postoperative pain control with an elastomeric pain pump following cardiothoracic surgery** Chopra A, et al. Pain Medicine 2017; 0: 1-5. PharmD. Departments of Pharmacy and Medical Education. St. John Hospital and Medical Center - Detroit, MI *https://pubmed.ncbi.nlm.nih.gov/28074028*	III	Retrospective Comparison 200 Pts • 100 received continuous bupivacaine infusion for 96 hours • 100 received traditional pain management	ON-Q Dual pump with bilateral subpectoral catheters Cardiothoracic via Median Sternotomy	• Respiratory depression was more common in patients with ON-Q (4% vs.0%) • Re-intubation rate was the same between groups	• After first 24 hrs, ON-Q group used less opioids each 24-hr period for 96 hrs, NS (P=.14-0.31) • Pain scores were similar between groups • No difference between use of ketorolac or acetaminophen
26	**Application of continuous incisional infusion of local anesthetic after major pediatric urological surgery** Hidas G et al. J of Ped Urology 2013; 9; 927-31. Urology, Children's Hospital – Orange County, CA *https://pubmed.ncbi.nlm.nih.gov/25746712*	III	Case Control 40 Pts • 20 received ON-Q 0.25% bupivacaine @ 1-4 ml/hr • 20 received IV analgesia	ON-Q Major Urological procedures	• No differences in frequency of fever between groups • No S/S of local anesthetic toxicity • No sign of infection, seromas or delayed wound healing • No reported instances of the patients stepping or pulling on the pump	• ON-Q group had significantly lower maximum pain compared to control on POD 1 (3 vs.5.2, P=.03) • Trend toward lower pain scores with ON-Q on POD 2 • IV and oral analgesia was significantly lower in ON-Q group on day of surgery and POD 1
27	**Improving postoperative pain management in subpectoral tissue expander implant reconstruction of the breast using an elastomeric pump** Chaudry A et al. Ann R Coll Surg Engl. 2015; 97: 364-68. MD. Great Western Hospital NHS Foundation Trust – UK *https://pubmed.ncbi.nlm.nih.gov/26264088*	III	Retrospective Comparison 50 Pts • 25 received elastomeric infusion of local anesthetic @ 5mL/hr • 25 control	B. Braun EasyPump (ON-Q) Mastectomy and insertion of subpectoral tissue expander implant	• No catheter dislodgements • No mechanical pump failures or difficulty removing catheters	• Pain scores significantly lower at 24 hrs in pump group (P≤.0001) • Length of stay was lower in pump group, though not statistically significant. (P=.15) • 22 Pts required no opioids in pump group compared to 0 in control group

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28	**Paraincisional subcutaneous infusion of ropivacaine after open abdominal vascular surgery shows significant advantages** Chaykovska et al. Annals of Vascular Surgery May 2014; 28:4; 837-844. Cardiovascular Surgery, University Hospital – Zurich, Switzerland ***https://pubmed.ncbi.nlm.nih.gov/24456863***	III	Retrospective Single-Center Study 58 Pts	ON-Q with soaker catheters Equivalent: Perfusor Pump-Syringe (B.Braun) Open Abdominal surgery for aortic aneurysm/Midline Laparotomy	• No surgical complication caused by installation of the para-incisional sub-q catheter (PSC) • No would infection or wound-healing disorders • 2 Pts with ESRD developed neuro symptoms (light-headedness, tinnitus, numbness of tongue) and had increase concentration of ropivacaine in blood and diagnosed with ropivacaine intoxication (dose decreased) • Caution should be used when administering local anesthetic in patients with renal impairment	Treatment group: • Post-op pain was the same as control group POD 1 and 2, but significantly less on POD 3 • Received significantly less morphine every day during the 5-day postoperative period • Achieved complete pain relief quicker • Using continuous injection reduces amount of manipulations on the catheter port and therefore reduces risk of catheter contamination and/or wound infection
29	**Efficacy and safety of continuous local infusion of ropivacaine after retroperineoscopic live donor nephrectomy** Biglarnia AR et al. American Journal of Transplantation 2011; 11: 93-100. Surgeon, Uppsala University Hospital – Uppsala, Sweden ***https://pubmed.ncbi.nlm.nih.gov/21199350***	III	Case Control 40 donors 40 cohorts	ON-Q with silver soaker Live Donor Nephrectomy	ON-Q group: • Leakage of fluid from incision in ON-Q group, which required an increased number of dressing changes • Sharp peel-away needles replaced with blunt trocars for introducing the catheter; potential cause of hematoma in one patient • Asymptomatic serous fluid evacuated from incision from one patient	ON-Q group: • Lower morphine equivalent consumption, 7 mg vs. 42 mg (P<.0000001) • Less nausea (45% vs. 87%, P<.001) • Shorter time in PACU (160 vs. 242.5 min, P<.001)
30	**Continuous infusion of bupivacaine reduces postoperative morphine use in adolescent idiopathic scoliosis after posterior spine fusion** Ross P et al. Spine 2011 Aug 15; 38(18): 1478-83. Surgeon, Children's' Hospital of Los Angeles - Los Angeles, CA ***https://pubmed.ncbi.nlm.nih.gov/20881514***	III	Retrospective Analysis 244 Pts	ON-Q Spine	• Significantly less antiemetic meds administered to ON-Q group (70.5% vs. 82.2%, P=.0001)	ON-Q group: • Less morphine required (32.6% vs. 85.2%, P<.001) • Overall reduction in morphine (18.9 mg vs. 26.4 mg, P<.001) • ON-Q group had higher pain scores at 18 hours (1.7 vs. 2.7, P=.002) • No significant difference in postoperative morphine use based on depth of catheter placement
31	**Decreased narcotic use with an implantable local anesthetic catheter after deep inferior epigastric perforator breast flap construction** Boehmler J et al. Ann Plastic Surg 2009; 62: 618-620. Surgeon, Georgetown University Hospital – Washington, DC ***https://pubmed.ncbi.nlm.nih.gov/19461271***	III	Prospective Historical control 40 Pts	ON-Q Breast Reconstruction	• No complications associated with ON-Q	• Significantly less total narcotic use in ON-Q Group (P=.02)

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32	**Use of the ON-Q pain pump management system in the head and neck: preliminary report** Charous S. Otolaryngology – Head and Neck Surgery 2008; 138:110-112. Surgeon, Rush University Medical Center – Chicago, IL *https://pubmed.ncbi.nlm.nih.gov/18165004*	III	Retrospective Comparison 28 Pts	ON-Q Thyroid Parathyroid Neck Dissection	• No wound infections, nerve paresthesia or catheter related complications	ON-Q group: • Decreased pain scores on POD 1 (P=.0001) • Decrease in opioid usage (P=.025) • Significantly less nausea and vomiting
33	**Postoperative continuous paravertebral anesthetic infusion for pain control in lumbar spinal fusion surgery** Elder J et al. Spine 2008; 33: 210-218. USC California Keck School of Medicine – Los Angeles, CA *https://pubmed.ncbi.nlm.nih.gov/18197109*	III	Case Control 50 Pts	ON-Q Lumbar Spinal Fusion	• 4 catheters were accidentally dislodged • 1 patient from each group developed a wound infection	ON-Q group: • Earlier return to bowel function (P=.048) • Used 45.7% less narcotics (P=.044) • Reported 45% less pain on POD 1-6 (P=.006-.046)
34	**Postoperative continuous paravertebral anesthetic infusion for pain control in posterior cervical spine surgery: a case-control study** Elder J et al. Neurosurgery 2010; 66: 99-107. Surgeon, University of Southern California Keck School of Medicine – Los Angeles, CA *https://pubmed.ncbi.nlm.nih.gov/20173578*	III	Case Control 25 Pts	ON-Q Cervical Spinal Fusion	• 3 catheters accidentally removed before 72 hours • No immediate complications attributed to the device	ON-Q group compared to control: • 34.4% less morphine use (P=.02) • Pain Scores lower on POD 1, 3, 4 (P<.05) • Time to first BM, discharge home, d/c of PCA also significantly less than control (P<.05)
35	**Reduction or elimination of postoperative pain medication after mastectomy through use of temporarily placed local anesthetic pump vs. control group** Morrison JE. Zentralblatt für Gynäkologie. 2003; 125: 17-22. Surgeon, Fayette Medical Center – Fayette, AL *https://pubmed.ncbi.nlm.nih.gov/12877104*	III	Prospective Historical control 49 Pts	ON-Q Mastectomy	• No complications reported	ON-Q group compared to control: • Did not request any post-operative opioids (18.2% vs. 3.7%, P=.1) • Total opioids usage in dose equivalents was 62.8% lower (1.25 vs. 3.36, P=.016) • LOS reduced by 0.5 days • Reduced ICU stay

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36	**Improved pain management outcomes with continuous infusion of a local anesthetic after thoracotomy** Wheatley G et al. Journal of Thoracic and Cardiovascular Surgery 2005; 130: 464-468. Surgeon, University of Texas Southwestern Medical Center – Dallas, TX ***https://pubmed.ncbi.nlm.nih.gov/16077414***	III	Retrospective Comparison 110 Pts	ON-Q Thoracotomy	• No infections or wound healing complications	ON-Q groups compared to control: • Less narcotic use by both ON-Q groups compared to epidural (P<.001) • Lower pain scores by both ON-Q groups compared to epidural group (P<.001) • No difference in time to first bowel movement or progression to normal diet
37	**Continuous infusion of local anesthetic decreases narcotic use and length of hospitalization after laparoscopic renal surgery** Yoost T et al. Journal of Endourology 2009; 23: 623-626. Surgeon, Medical University of SC – Charleston, SC ***https://pubmed.ncbi.nlm.nih.gov/19335329***	III	Retrospective Review 38 Pts	ON-Q Lumbar Spinal Fusion	• No infections or wound healing complications	• Decreased morphine use in ON-Q group • Decreased LOS in ON-Q group (1.8 vs. 2.9 days, P=.01)
38	**ON-Q pump for pain control after orbital implant surgery** Samimi DB et al. Ophthal Plast Reconstr Surg. 2014 Sep-Oct; 30(5): 396-9 Opthalmology, University of Southern California – Los Angeles, CA ***https://pubmed.ncbi.nlm.nih.gov/24777268***	IV	Retrospective Non-comparative consecutive case review 20 Pts	On-Q with silver soaker catheters Enucleation Evisceration Secondary Orbital Implantation	• 2 Pts experienced postoperative nausea • 1 catheter connector leaked • 2 Pts with renal disease had signs/symptoms of local anesthetic toxicity; resolved with dose reduction • No wound infection/healing disorders	• Among 20 patients, mean postoperative period pain score, with On-Q in place, was 1.3 (scale of 0 to 10) • 9 patients (45%) did not require adjunctive oral narcotics
39	**Outpatient analgesia via paravertebral peripheral nerve block catheter and ON-Q pump – a case series** Visoiu M. Paediatr Anaesth. 2014 Aug; 24(8): 875-8. Department of Anesthesiology, Children's Hospital of Pittsburgh of University of Pittsburgh Medical Center - Pittsburgh, PA ***https://pubmed.ncbi.nlm.nih.gov/24815589***	IV	Case Report 5 pediatric Pts 0.2% ropivacaine @ 4-6mL/hr	ON-Q with SAF Iliac Crest Bone Harvesting	• No complications related to catheters	• Pain scores were low and analgesic medication consumption was minimal • Outpatient PVB can be beneficial as part of multimodal analgesia for pediatric patients
40	**Continuous peripheral nerve blockade for inpatient and outpatient postoperative analgesia in children** Ganesh et al. Anesth Analg 2007; 105: 1234-42. Anesthesiologist, The Children's' Hospital of Philadelphia – Philadelphia, PA ***https://pubmed.ncbi.nlm.nih.gov/17959949***	IV	Retrospective 203 Pts (4-18 y/o)	ON-Q CPNB (orthopedic)	• Feasible to implement CPNB program at home • Pt and family f/u critical to detect adverse events • 2.8% of Pts had complications (resolved) • 3 Pts had prolonged numbness > 24 h (resolved spontaneously) • 1 Pt had superficial cellulitis • 1 Pt had tinnitus	• Percentage of Pts not requiring opioids in the first 8, 24, and 48 h after surgery was 56%, 26%, and 21%, respectively • 50% of Pts were discharged home with catheter(s) • 99% of catheters were removed successfully at home • Higher rate of dislodgement of interscalene catheters, possibly due to short insertion depth and securement

#	STUDY	LOE	DESIGN	DEVICE/PROCEDURE	CONCLUSION	
					SAFETY	PERFORMANCE
41	**Successful continuous interscalene analgesia for ambulatory shoulder surgery in a private practice setting** Fredrickson M et al. Reg Anesth Pain Med 2008; 33: 122-128. Anesthesiologist, The University of Auckland – Auckland, New Zealand *https://pubmed.ncbi.nlm.nih.gov/18299092*	IV	Prospective Series 300 Pts	ON-Q with ONDEMAND CPNB (shoulder)	• No S/S of LA toxicity, pneumothorax, or spinal/epidural anesthesia	• 98% of Pts avoided supplemental opioids • Weight and cumbersome nature of the ambulatory pump mentioned by 16/100 Pts • Majority of Pts would request again
42	**23-hour TKA in 10 opioid pills or less through 90 days: A non-selected 23-hour TKA in 10 opioid pills or less through 90 days: A non-selected prospective consecutive one year cohort** Stevenson, M and Wickline, A. Journal of Orthopedic Experience and Innovation July 6, 2020. Surgeon, Genesee Orthopedics, St Elizabeth Medical Center – Utica, NY *https://journaloei.scholasticahq.com/article/13423-23-hour-tka-in-10-opioid-pills-or-less-through-90-days-a-non-selected-prospective-consecutive-one-year-cohort*	IV	Prospective Case Series 386 Pts	ON-Q CACB (TKA)	• 8 Pts (2%) had motor weakness on DOS; treated with knee immobilizer without sequala • 3 Pts inadvertently pulled out CACB catheter • 9 Pts (3.1%) discontinued CACB catheter earlier than necessary • 2 Pts (1%) had uncontrolled pain on DOS and 2 on POD#1 • 2 Pts complained of bleeding from the CACB catheter site • 14 falls over the 12-week post-op period without sequelae • 1 Pt had saphenous paresthesia at 6 weeks post-op; resolved by week 12	• 86.3% Pts required 10 pills or less through 12 weeks • 18.9% Pts required no opioid pills through 12 weeks • 50.5% Pts took only tramadol rather than stronger opioids • 85.4% Pts required no formal physical therapy (PT) through 12 weeks • 63.2% Pts were discharged DOS • 91.2% Pts were discharged by POD #1 • 311 of 386 (80.6%) Pts completed all KOOS Jr. evaluations • Mean KOOS Jr score increased from 53.1 at baseline to 71.8 at 6 weeks; 90.0 at 12 weeks • Mean flexion was 109.2 degrees at 3 weeks and 115.8 at 6 weeks • 90-day readmission rate was 1.2% • A novel multimodal protocol combining consistent and patient specific preoperative education, CACB, and self-directed and unsupervised postoperative rehabilitation dramatically reduces narcotic needs, formal physical therapy needs, and decreases length of stay following TKA

ABBREVIATIONS

ACL	Anterior Cruciate Ligament	**POD**	Post-op Day	**CABG**	Coronary Arterial Bypass Graft	**CACB**	Continuous Adductor Canal Block
DOS	Day of Surgery	**PONV**	Postoperative Nausea and Vomiting	**Cath**	Catheter	**Pts**	Patients
CC	Case Control	**RCT**	Randomized Controlled Trial	**CPNB**	Continuous Peripheral Nerve Block	**SAF**	Select-A-Flow
LA	Local Anesthetic	**SQ**	Subcutaneous	**LOE**	Level of Evidence	**S/S**	Signs and Symptoms
LOS	Length of Stay	**TKA**	Total knee arthroplasty	**NS**	Not Significant	**VAS**	Visual Analog Score (Pain Scores)
PCA	Patient Controlled Analgesia						