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The handle <http://hdl.handle.net/1887/28397> holds various files of this Leiden University dissertation.

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Title: Acute and chronic pain after cardiac surgery

Issue Date: 2014-09-02



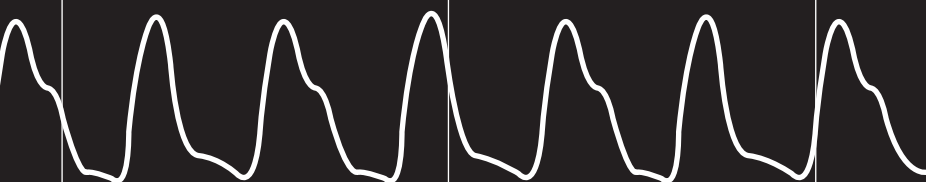
ECG

80



SpO₂

98%



ART

167
69



Pain?

SCOPE AND INTENT OF THE INVESTIGATIONS

CH. 2 section I



This thesis focuses on acute and chronic pain in patients after cardiac surgery. Issues addressed are the incidence of acute pain after sternotomy, the impact of the introduction of a pain management program on acute pain and pain treatment in the ICU with a special focus on the effect of morphine on procedural pain, changes in stress hormones during procedural pain, and adherence to the pain protocol. The second part addresses the presence of chronic pain one year after cardiac surgery and potential risk factors for chronic pain, including acute pain experienced while in the ICU.

Acute pain

In **Chapter 3** we described the implementation of a pain management program for pain at rest after cardiac surgery in the ICU, which improved quality of pain management. In a next study, the OPCIC study (OPCIC; Optimization of Procedural Pain Control in Intensive Care Unit Patients, EudraCT number 2007-003722-18) we focused on pain management of *procedure related* pain. The study compared the efficacy of a bolus of 2.5 mg of intravenous morphine with 7.5 mg for the relief of procedural pain (**Chapter 4**). In order to find objective parameters to identify pain in patients in the ICU, we related changes in plasma levels of various stress hormones before and after the intervention with the levels of self-reported pain (**Chapter 5**). This was followed by a study on the adherence to the pain protocol which discusses various reasons for deviating from the pain protocol and possible steps to improve protocol adherence (**Chapter 6**).

Chronic pain

Chapter 7 and 8 explore associations between possible perioperative risk factors, including acute postoperative pain, and the occurrence of chronic pain one year after cardiac surgery. Accurate and prospective data on acute pain were obtained from previous studies in the same patients, described in chapters 3 and 4.

Conclusions and perspectives

The results of the research described in this thesis are summarized and discussed in **Chapter 9**.

References

- Mueller, X.M., F. Tinguely, H.T. Tevaearai, J.P. Revelly, R. Chiolero, and L.K. von Segesser, Pain location, distribution, and intensity after cardiac surgery. *Chest*, 2000. 118(2): p. 391-6.
- Gelinas, C., Management of pain in cardiac surgery ICU patients: have we improved over time? *Intensive Crit Care Nurs*, 2007. 23(5): p. 298-303.
- Chanques, G., S. Jaber, E. Barbotte, S. Violet, M. Sebbane, P.F. Perrigault, C. Mann, J.Y. Lefrant, and J.J. Eledjam, Impact of systematic evaluation of pain and agitation in an intensive care unit. *Crit Care Med*, 2006. 34(6): p. 1691-9.
- Perkins, F.M. and H. Kehlet, Chronic pain as an outcome of surgery. A review of predictive factors. *Anesthesiology*, 2000. 93(4): p. 1123-33.
- Kehlet, H., T.S. Jensen, and C.J. Woolf, Persistent postsurgical pain: risk factors and prevention. *Lancet*, 2006. 367(9522): p. 1618-25.
- Lahtinen, P., H. Kokki, and M. Hynynen, Pain after cardiac surgery: a prospective cohort study of 1-year incidence and intensity. *Anesthesiology*, 2006. 105(4): p. 794-800.
- Searle, R.D., M.P. Simpson, K.H. Simpson, R. Milton, and M.I. Bennett, Can chronic neuropathic pain following thoracic surgery be predicted during the postoperative period? *Interact Cardiovasc Thorac Surg*, 2009. 9(6): p. 999-1002.
- Voscopoulos, C. and M. Lema, When does acute pain become chronic? *Br J Anaesth*, 2010. 105 Suppl 1: p. i69-85.
- Eisenberg, E., Y. Pultorak, D. Pud, and Y. Bar-El, Prevalence and characteristics of post coronary artery bypass graft surgery pain (PCP). *Pain*, 2001. 92(1-2): p. 11-7.
- Kalso, E., S. Mennander, T. Tasmuth, and E. Nilsson, Chronic post-sternotomy pain. *Acta Anaesthesiol Scand*, 2001. 45(8): p. 935-9.
- Meyerson, J., S. Thelin, T. Gordh, and R. Karlsten, The incidence of chronic post-sternotomy pain after cardiac surgery-a prospective study. *Acta Anaesthesiol Scand*, 2001. 45(8): p. 940-4.
- Gjeilo, K.H., P. Klepstad, A. Wahba, S. Lydersen, and R. Stenseth, Chronic pain after cardiac surgery: a prospective study. *Acta Anaesthesiol Scand*, 2010. 54(1): p. 70-8.
- H. Merskey and N. Bogduk, ed. *Classification of Chronic Pain Second Edition ed. Part III: Pain Terms, A Current List with Definitions and Notes on Usage*, ed. I.T.F.o. Taxonomy. 1994, IASP Press: Seattle. pp 209-214.
- Melzack R., P.D.W., *Handbook of pain management : a clinical companion to Wall and Melzack's Textbook of pain*. 2003: Churchill Livingstone.
- Payen, J.F., G. Chanques, J. Mantz, C. Hercule, I. Auriant, J.L. Leguillou, M. Binhas, C. Genty, C. Rolland, and J.L. Bosson, Current practices in sedation and analgesia for mechanically ventilated critically ill patients: a prospective multicenter patient-based study. *Anesthesiology*, 2007. 106(4): p. 687-95; quiz 891-2.
- Puntillo, K.A., C. White, A.B. Morris, S.T. Perdue, J. Stanik-Hutt, C.L. Thompson, and L.R. Wild, Patients' perceptions and responses to procedural pain: results from Thunder Project II. *Am J Crit Care*, 2001. 10(4): p. 238-51.
- Puntillo, K.A., Dimensions of procedural pain and its analgesic management in critically ill surgical patients. *Am J Crit Care*, 1994. 3(2): p. 116-22.
- Epstein, J. and M.J. Breslow, The stress response of critical illness. *Crit Care Clin*, 1999. 15(1): p. 17-33, v.
- Hamill-Ruth, R.J. and M.L. Marohn, Evaluation of pain in the critically ill patient. *Crit Care Clin*, 1999. 15(1): p. 35-54, v-vi.

20. Lewis, K.S., J.K. Whipple, K.A. Michael, and E.J. Quebbeman, Effect of analgesic treatment on the physiological consequences of acute pain. *Am J Hosp Pharm*, 1994. 51(12): p. 1539-54.
21. Boulain, T., Unplanned extubations in the adult intensive care unit: a prospective multicenter study. *Association des Reanimateurs du Centre-Ouest. Am J Respir Crit Care Med*, 1998. 157(4 Pt 1): p. 1131-7.
22. Chevron, V., J.F. Menard, J.C. Richard, C. Girault, J. Leroy, and G. Bonmarchand, Unplanned extubation: risk factors of development and predictive criteria for reintubation. *Crit Care Med*, 1998. 26(6): p. 1049-53.
23. Fraser, G.L., R.R. Riker, B.S. Prato, and M.L. Wilkins, The frequency and cost of patient-initiated device removal in the ICU. *Pharmacotherapy*, 2001. 21(1): p. 1-6.
24. Barr, J., G.L. Fraser, K. Puntillo, E.W. Ely, C. Gelinas, J.F. Dasta, J.E. Davidson, J.W. Devlin, J.P. Kress, A.M. Joffe, D.B. Coursin, D.L. Herr, A. Tung, B.R. Robinson, D.K. Fontaine, M.A. Ramsay, R.R. Riker, C.N. Sessler, B. Pun, Y. Skrobik, and R. Jaeschke, Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. *Crit Care Med*, 2013. 41(1): p. 263-306.
25. JJ Spijkstra, J Horn, SEMJ Gielen-Wijffels, D Burger, B van den Berg, and F. Snellen, Herziene richtlijn analgesie en sedatie voor volwassen patiënten op de intensive care. 2013.
26. Devlin, J.W., A.M. Holbrook, and H.D. Fuller, The effect of ICU sedation guidelines and pharmacist interventions on clinical outcomes and drug cost. *Ann Pharmacother*, 1997. 31(6): p. 689-95.
27. MacLaren, R., J.M. Plamondon, K.B. Ramsay, G.M. Rocker, W.D. Patrick, and R.I. Hall, A prospective evaluation of empiric versus protocol-based sedation and analgesia. *Pharmacotherapy*, 2000. 20(6): p. 662-72.
28. Brook, A.D., T.S. Ahrens, R. Schaiff, D. Prentice, G. Sherman, W. Shannon, and M.H. Kollef, Effect of a nursing-implemented sedation protocol on the duration of mechanical ventilation. *Crit Care Med*, 1999. 27(12): p. 2609-15.
29. Kress, J.P., A.S. Pohlman, M.F. O'Connor, and J.B. Hall, Daily interruption of sedative infusions in critically ill patients undergoing mechanical ventilation. *N Engl J Med*, 2000. 342(20): p. 1471-7.
30. Payen, J.F., J.L. Bosson, G. Chanques, J. Mantz, and J. Labarere, Pain assessment is associated with decreased duration of mechanical ventilation in the intensive care unit: a post Hoc analysis of the DOLOREA study. *Anesthesiology*, 2009. 111(6): p. 1308-16.
31. Jensen, M.P., P. Karoly, and S. Braver, The measurement of clinical pain intensity: a comparison of six methods. *Pain*, 1986. 27(1): p. 117-26.
32. Gezondheidszorg, I.v.d., Kwaliteitsindicatoren basisset ziekenhuizen. 2013: p. 24-27.
33. Kehlet, H. and J.P. Rathmell, Persistent postsurgical pain: the path forward through better design of clinical studies. *Anesthesiology*, 2010. 112(3): p. 514-5.
34. Taillefer, M.C., M. Carrier, S. Belisle, S. Levesque, H. Lanctot, A.M. Boisvert, and M. Choiniere, Prevalence, characteristics, and predictors of chronic nonanginal postoperative pain after a cardiac operation: a cross-sectional study. *J Thorac Cardiovasc Surg*, 2006. 131(6): p. 1274-80.

35. Bruce, J., N. Drury, A.S. Poobalan, R.R. Jeffrey, W.C. Smith, and W.A. Chambers, The prevalence of chronic chest and leg pain following cardiac surgery: a historical cohort study. *Pain*, 2003. 104(1-2): p. 265-73.
36. Pezzella, A.T., Global aspects of cardiothoracic surgery with focus on developing countries. *Asian Cardiovasc Thorac Ann*, 2010. 18(3): p. 299-310.
37. Ahlers, S.J., L. van Gulik, A.M. van der Veen, H.P. van Dongen, P. Bruins, S.V. Belitser, A. de Boer, D. Tibboel, and C.A. Knibbe, Comparison of different pain scoring systems in critically ill patients in a general ICU. *Crit Care*, 2008. 12(1): p. R15.
38. Diby, M., J.A. Romand, S. Frick, C.P. Heidegger, and B. Walder, Reducing pain in patients undergoing cardiac surgery after implementation of a quality improvement postoperative pain treatment program. *J Crit Care*, 2008. 23(3): p. 359-71.
39. Skrobik, Y., S. Ahern, M. Leblanc, F. Marquis, D.K. Awissi, and B.P. Kavanagh, Protocolized intensive care unit management of analgesia, sedation, and delirium improves analgesia and subsyndromal delirium rates. *Anesth Analg*, 2010. 111(2): p. 451-63.
40. Mansouri, P., S. Javadpour, F. Zand, F. Ghodsbin, G. Sabetian, M. Masjedi, and H.R. Tabatabaee, Implementation of a protocol for integrated management of pain, agitation, and delirium can improve clinical outcomes in the intensive care unit: A randomized clinical trial. *J Crit Care*, 2013.
41. Robinson, B.R., E.W. Mueller, K. Henson, R.D. Branson, S. Barsoum, and B.J. Tsuei, An analgesia-delirium-sedation protocol for critically ill trauma patients reduces ventilator days and hospital length of stay. *J Trauma*, 2008. 65(3): p. 517-26.
42. Arabi, Y., S. Haddad, R. Hawes, T. Moore, M. Pillay, B. Naidu, A. Issa, B. Yeni, C. Grant, and A. Alshimemeri, Changing sedation practices in the intensive care unit--protocol implementation, multifaceted multidisciplinary approach and teamwork. *Middle East J Anesthesiol*, 2007. 19(2): p. 429-47.
43. Hager, D.N., V.D. Dinglas, S. Subhas, A.M. Rowden, K.J. Neufeld, O.J. Bienvenu, P. Touradji, E. Colantuoni, D.R. Reddy, R.G. Brower, and D.M. Needham, Reducing deep sedation and delirium in acute lung injury patients: a quality improvement project. *Crit Care Med*, 2013. 41(6): p. 1435-42.
44. Porhomayon, J., N.D. Nader, A.A. El-Solh, M. Hite, J. Scott, and K. Silinskie, Pre- and post-intervention study to assess the impact of a sedation protocol in critically ill surgical patients. *J Surg Res*, 2013. 184(2): p. 966-972 e4.
45. Brattebo, G., D. Hofoss, H. Flaatten, A.K. Muri, S. Gjerde, and P.E. Plsek, Effect of a scoring system and protocol for sedation on duration of patients' need for ventilator support in a surgical intensive care unit. *Qual Saf Health Care*, 2004. 13(3): p. 203-5.
46. Bucknall, T.K., E. Manias, and J.J. Presneill, A randomized trial of protocol-directed sedation management for mechanical ventilation in an Australian intensive care unit. *Crit Care Med*, 2008. 36(5): p. 1444-50.
47. Elliott, R., S. McKinley, L.M. Aitken, and J. Hendrikz, The effect of an algorithm-based sedation guideline on the duration of mechanical ventilation in an Australian intensive care unit. *Intensive Care Med*, 2006. 32(10): p. 1506-14.
48. De Jonghe, B., S. Bastuji-Garin, P. Fangio, J.C. Lacherade, J. Jabot, C. Appere-De-Vecchi, N. Rocha, and H. Outin, Sedation algorithm in critically ill patients without acute brain injury. *Crit Care Med*, 2005. 33(1): p. 120-7.

49. Hahn, L., J. Beall, R.S. Turner, T.W. Woolley, and M. Hahn, Pharmacist-developed sedation protocol and impact on ventilator days. *J Pharm Pract*, 2013. 26(4): p. 406-8.
50. Quenot, J.P., S. Ladoire, F. Devoucoux, J.M. Doise, R. Cailliod, N. Cunin, H. Aube, B. Blettery, and P.E. Charles, Effect of a nurse-implemented sedation protocol on the incidence of ventilator-associated pneumonia. *Crit Care Med*, 2007. 35(9): p. 2031-6.
51. Segerdahl, M., Procedural pain--time for its recognition and treatment! *Eur J Pain*, 2008. 12(1): p. 1-2.
52. Siffleet, J., J. Young, S. Nikoletti, and T. Shaw, Patients' self-report of procedural pain in the intensive care unit. *J Clin Nurs*, 2007. 16(11): p. 2142-8.
53. Casey, E., A. Lane, D. Kuriakose, S. McGeary, N. Hayes, D. Phelan, and D. Buggy, Bolus remifentanyl for chest drain removal in ICU: a randomized double-blind comparison of three modes of analgesia in post-cardiac surgical patients. *Intensive Care Med*, 2010. 36(8): p. 1380-5.
54. Demir, Y. and L. Khorshid, The effect of cold application in combination with standard analgesic administration on pain and anxiety during chest tube removal: a single-blinded, randomized, double-controlled study. *Pain Manag Nurs*, 2010. 11(3): p. 186-96.
55. Joshi, V.S., S. Chauhan, U. Kiran, A.K. Bisoi, and P.M. Kapoor, Comparison of analgesic efficacy of fentanyl and sufentanil for chest tube removal after cardiac surgery. *Ann Card Anaesth*, 2007. 10(1): p. 42-5.
56. Singh, M. and R. Gopinath, Topical analgesia for chest tube removal in cardiac patients. *J Cardiothorac Vasc Anesth*, 2005. 19(6): p. 719-22.
57. Akrofi, M., S. Miller, S. Colfar, P.R. Corry, B.M. Fabri, M.D. Pullan, G.N. Russell, and M.A. Fox, A randomized comparison of three methods of analgesia for chest drain removal in postcardiac surgical patients. *Anesth Analg*, 2005. 100(1): p. 205-9.
58. Puntillo, K.A., Effects of interpleural bupivacaine on pleural chest tube removal pain: a randomized controlled trial. *Am J Crit Care*, 1996. 5(2): p. 102-8.
59. Puntillo, K. and S.J. Ley, Appropriately timed analgesics control pain due to chest tube removal. *Am J Crit Care*, 2004. 13(4): p. 292-301; discussion 302; quiz 303-4.
60. Bryden, F.M., H. McFarlane, M.E. Tunstall, and J.A. Ross, Isoflurane for removal of chest drains after cardiac surgery. *Anaesthesia*, 1997. 52(2): p. 173-5.
61. Leape, L.L., J.S. Weissman, E.C. Schneider, R.N. Piana, C. Gatsonis, and A.M. Epstein, Adherence to practice guidelines: the role of specialty society guidelines. *Am Heart J*, 2003. 145(1): p. 19-26.
62. Brindis, R.G. and C. Sennett, Physician adherence to clinical practice guidelines: does it really matter? *Am Heart J*, 2003. 145(1): p. 13-5.
63. Ceelie, I., S.N. de Wildt, M. de Jong, E. Ista, D. Tibboel, and M. van Dijk, Protocolized post-operative pain management in infants; do we stick to it? *Eur J Pain*, 2012. 16(5): p. 760-6.
64. Devlin, J.W., F. Marquis, R.R. Riker, T. Robbins, E. Garpestad, J.J. Fong, D. Didomenico, and Y. Skrobik, Combined didactic and scenario-based education improves the ability of intensive care unit staff to recognize delirium at the bedside. *Crit Care*, 2008. 12(1): p. R19.
65. Watt-Watson, J., B. Stevens, J. Costello, J. Katz, and G. Reid, Impact of preoperative education on pain management outcomes after coronary artery bypass graft surgery: a pilot. *Can J Nurs Res*, 2000. 31(4): p. 41-56.

66. Franck, L.S. and E. Bruce, Putting pain assessment into practice: why is it so painful? *Pain Res Manag*, 2009. 14(1): p. 13-20.
67. Czarnecki, M.L., K. Simon, J.J. Thompson, C.L. Armus, T.C. Hanson, K.A. Berg, J.L. Petrie, Q. Xiang, and S. Malin, Barriers to pediatric pain management: a nursing perspective. *Pain Manag Nurs*, 2011. 12(3): p. 154-62.
68. Cabana, M.D., C.S. Rand, N.R. Powe, A.W. Wu, M.H. Wilson, P.A. Abboud, and H.R. Rubin, Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA*, 1999. 282(15): p. 1458-65.
69. Niraj, G. and D.J. Rowbotham, Persistent postoperative pain: where are we now? *Br J Anaesth*, 2011. 107(1): p. 25-9.
70. Macrae, W.A., Chronic pain after surgery. *Br J Anaesth*, 2001. 87(1): p. 88-98.
71. Steegers, M.A., A. van de Luitgaarden, L. Noyez, G.J. Scheffer, and O.H. Wilder-Smith, The role of angina pectoris in chronic pain after coronary artery bypass graft surgery. *J Pain*, 2007. 8(8): p. 667-73.
72. King, K.M., M. Parry, D. Southern, P. Faris, and R.T. Tsuyuki, Women's Recovery from Sternotomy-Extension (WREST-E) study: examining long-term pain and discomfort following sternotomy and their predictors. *Heart*, 2008. 94(4): p. 493-7.

