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Surgical treatment of chronic subdural haematoma under monitored anaesthesia care

Preliminary results of a prospective study in 20 consecutive cases

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Summary

Questions under study: General and local uses of anaesthesia are the preferred common methods in the surgical treatment of chronic subdural haematoma (CSDH). The literature provides no information regarding monitored anaesthesia care during surgery of CSDH. In this report we evaluate the clinical results of surgical treatment for CSDH under monitored anaesthesia care.

Method: Between 2001 and 2006 twenty consecutive patients with 24 CSDHs were surgically treated under monitored anaesthesia care at one institution. The clinical success of the procedure under monitored anaesthesia care, patient satisfaction, length of hospitalisation, anaesthesia-related complications and neurological outcome were analysed.

Results: Mean age was 60.9 years, with 15 patients aged over 60. ASA physical condition score was IV in 11 patients, III in 1, II in 4 and I in 4. In all patients CSDH was successfully drained by burr hole craniotomy under monitored anaesthesia care. There was no anaesthesia-related morbidity or mortality. Mean hospital stay was 4.5 days.

Conclusion: Preliminary results indicate that surgery for CSDH under monitored anaesthesia care is safe and effective. Conscious sedation using monitored anaesthesia care, that is a middle ground between general anaesthesia and local anaesthesia, may facilitate patient comfort and surgical competence during surgery for CSDH.

Key words: anaesthesia; chronic subdural haematoma; monitored anaesthesia care; surgical treatment

Introduction

Chronic subdural haematoma (CSDH) represents one of the most frequent clinical entities encountered in daily neurosurgical practice [8–10, 17]. CSDH is more common among elderly patients, many of whom present with associated serious systemic problems. Coexisting systemic disease usually poses a problem for general anaesthesia in this particular patient group. On the other hand, as an alternative method to general anaesthesia, local anaesthesia for surgical treatment of CSDH is not consistently comfortable for either patient or surgeon. In recent years conscious sedation using monitored anaesthesia care has been employed in particular for patients undergoing surgical or diagnostic procedures for whom general anaesthesia carries a high risk [2, 6, 14, 25, 27]. This form of anaesthesia is considered a middle ground between general anaesthesia and local anaesthesia, and can facilitate patient comfort and surgical competence during the procedure. Currently, monitored anaesthesia care is commonly used in various surgical procedures, and its safety and efficacy has been proven by numerous studies. However, there is no report in the literature

Abbreviations

ASA	American Society of Anaesthesiologists
CSDH	Chronic subdural haematoma
MGS	Markwalder's Grading Scale

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concerning surgical treatment of CSDH under monitored anaesthesia care. In this study we share our preliminary experience with monitored anaesthesia care in CSDH surgery.

Methods

Between 2001 and 2006, 20 consecutive ASA physical condition score (table 1) I–IV patients (16 males and 4 females) with 24 CSDHs were treated surgically under monitored anaesthesia care at the Department of Neurosurgery, University of Dicle, Turkey. After institutional Ethics Committee approval patients or their relatives gave written informed consent to participation in this prospective clinical trial. Mean age was 60.9 years with a range from 18 to 93 years. In our patients the common presenting symptom was headache (80%), followed by hemiparesis (50%). Two patients were admitted with the symptoms of Jacksonian type seizures. Haematomas were unilateral in 16 patients and bilateral in 4. Neurological examination of the patients demonstrated hemiparesis in 10 patients (50%), hemihypoesthesia in 3 patients (16.6%), confusion in 4 patients (20%), paraparesis in 1 patient (5%) and dysphasia in 1 patient (5%), while neurological examination was normal in 2 patients (1%).

Table 1

American Society of Anesthesiologists (ASA) physical status classification.

Status	Disease state
ASA class 1	No organic, physiological, biochemical, or psychiatric disturbance
ASA class 2	Mild to moderate systemic disturbance that may not be related to the reason for surgery
ASA class 3	Severe systemic disturbance that may or may not be related to the reason for surgery
ASA class 4	Severe systemic disturbance that is life-threatening with or without surgery
ASA class 5	Moribund patient who has little chance of survival but is submitted to surgery as a last resort (resuscitative effort)
Emergency operation (E)	Any patient in whom an emergency operation is required

Table 2

Patient characteristics.

Patient No	Age	Gender	Symptom	Associated systemic disease	ASA-PS	Initial MGS	Haematoma volume (mL)	Operation time (min)	Duration of hospital stay (day)	Postoperative MGS	Sat. sc.	Follow-up (mo)
1	63	M	HA, dysphasia	HT, Cardiac disease, COPD	4	2	70	31	4	0	6	6
2*	77	M	HA, paraparesis	HT, COPD	4	2	75–30	58	5	0	5	9
3	18	M	HA, hemiparesis	–	1	2	100	35	4	0	6	5
4	71	M	HA, hemiparesis	–	1	2	125	32	6	0	5	8
5*	70	F	HA, seizure	HT	2	1	150–50	33	5	0	7	26
6	37	M	HA, seizure	–	1	1	70	40	3	0	6	28
7	57	M	HA, hemiparesis	Cirrhosis	4	2	100	36	5	0	3	28
8	66	M	HA, hemiparesis	DM, Cardiac disease	4	2	75	28	4	0	6	20
9	64	M	HA, hemiparesis	–	1	2	200	33	5	0	7	41
10	70	F	Confusion	Cirrhosis	4	2	75	31	3	0	5	63
11	73	M	HA, hemihipoesthesia	HT, Cardiac disease	4	2	50	35	5	0	6	61
12	70	M	HA, hemiparesis	HT, Cardiac disease	4	2	100	27	6	0	6	39
13	30	M	HA, hemiparesis	Cardiac disease	2	2	50	31	7	0	7	64
14	62	M	HA, hemihipoesthesia	Cardiac disease	2	2	75	33	5	0	7	39
15	55	M	HA, hemihipoesthesia	Hepatitis C, Cirrhosis	4	2	100	41	4	0	7	7
16*	70	M	Hemiparesis, confusion	Cirrhosis	4	2	80–50	63	6	1	5	9
17	65	F	HA, hemiparesis	HT, Cardiac disease	3	2	100	25	5	0	6	13
18*†	65	F	Confusion	AML, COPD	4	2	120–60	43	5	1	5	–
19	93	M	Confusion	HT, Cardiac disease	4	2	150	40	7	1	5	3
20	43	M	HA, hemiparesis	–	2	2	200	33	4	0	6	2

* Bilateral subdural haematoma presentation. † This patient died of a complication of primary systemic disease on 30th postoperative day.
Abbreviations used in this table are: AML: acute myeloblastic leukaemia; ASA-PS: American Society of Anaesthesiologists physical status classification; COPD: chronic obstructive pulmonary disease; DM: diabetes mellitus; HA: headache; HT: hypertension; MGS: Markwalder's neurological grading scale; Sat. sc: Likert-like satisfaction score (refer to fig 1).

Figure 1

A 7-point Likert-like verbal rating scale for assessment of patients' satisfaction with intraoperative sedation/analgesia.

1	2	3	4	5	6	7
Extremely dissatisfied	Dissatisfied	Somewhat dissatisfied	Undecided	Somewhat satisfied	Satisfied	Extremely satisfied

Cardiac disease was the most frequent coexisting systemic disorder (40%) among patients. Other associated diseases in the patient group presented were hypertension, chronic obstructive pulmonary disease, cirrhosis, diabetes mellitus and acute myeloblastic leukaemia. Four patients had no systemic disease. In confused patients, any metabolic abnormality was ruled out to exclude the underlying cause of the mental status which might be related to the coexisting systemic disease. ASA physical condition score was IV in 11 patients (55.5%), III in one patient (5%), II in four patients (11%), and I in 4 patients (20%). The cases' characteristics are shown in table 2.

Patients' pre- and postoperative neurological status was evaluated by Markwalder's Neurological Grading Scale proposed for CSDH [15]: Grade 0: Patient neurologically normal. Grade 1: Patient alert and oriented; mild symptoms, such as headache; absent or mild symptoms or neurological deficit, such as reflex asymmetry. Grade 2: Patient drowsy or disoriented with variable neurological deficit, such as hemiparesis. Grade 3: Patient stuporous but responding appropriately to noxious stimuli; severe focal. Grade 4: Patient comatose with absent motor response to painful stimuli; decerebrate or decorticate posturing.

Anaesthesia procedure and operation

All surgical procedures were performed by one author (AG), and, similarly, monitored anaesthesia care was carried out by one anaesthesiologist (SK). Patients were excluded if they had a predicted difficult airway, a history of allergy to midazolam, fentanyl or a local anaesthetic drug, experienced memory or cognitive dysfunction, had a history of drug or alcohol abuse, or were taking sedative or analgesic drugs within two weeks prior to surgery. The patients were interviewed the day before surgery by a physician who explained the role of sedation and analgesia and the necessity of patient cooperation. No premedication was given before the patient's arrival in the operating theatre. On arriving in the operating theatre an intravenous (IV) canula was placed under local anaesthesia in the non-dominant arm for administration of fluids and IV medication. The CO_2 output-line of the capnograph was placed into one nostril to measure CO_2 expired by patient. Other standard monitors including electrocardiogram (ECG), noninvasive arterial pressure, peripheral arterial oxygen saturation (SpO_2), and respiratory rate (RR) were also applied, and oxygen was administered at 3 L/min with face masks. Baseline measurements of heart rate, mean arterial pressure and SpO_2 and RR were obtained. The patients' level of sedation was assessed by a blind observer using the Ramsey Sedation Score [4, 23]: Awake levels: Level 1) patient anxious and agitated or restless or both; 2) patient cooperative, oriented and tranquil; 3) patient responds to commands only. Asleep levels are dependent on the patient's response to a light glabellar tap or loud auditory stimulus: Level 4) a brisk response; 5) a sluggish response; and 6) no response.

All patients received an IV bolus of midazolam 0.03 mg/kg for induction [12]. Subsequently a continuous infusion of midazolam was administered at an infusion rate between 0.015–0.06 mg/kg/hr to generate level 2–3 of Ramsey sedation.

Concomitantly, all patients were given a fentanyl 0.5 µg/kg IV bolus followed by a continuous infusion dose at a rate of 0.25 µg/kg/min. Pain during the procedure was treated by a supplemental injection of fentanyl. In the dysphasic patient, besides moaning, a 20% increase in mean arterial pressure and a 10% increase in heart rate compared to baselines were considered to be insufficient analgesia, and 0.25 µg/kg supplemental fentanyl was administered five minutes before the surgeons began infiltrating the operative field with local anesthetics (2–3 ml 0.5% bupivacain).

The total dosages of the sedative and analgesic medications administered during the operation were recorded. Surgical procedure was briefly as follows: depending on the haematoma size, one burr-hole 2 cm in diameter for one side was made using a high-speed drill and a rongeur. Bilateral chronic haematomas were drained from both sides at the same operation. Haematoma evacuation was accomplished by dural and haematoma membrane incisions and partial membrane removal. Irrigation with saline was continued until the haematoma liquid had a clear appearance. In all patients haematoma evacuation was completed in a shorter period with minimal or no discomfort. The midazolam and fentanyl infusion was discontinued after placement of the final skin suture. A closed drainage system was placed in the subdural space and was left for 24–72 hours postoperatively. Mean operation time was 36.4 min (25–63 minutes). The patients were transferred directly to the recovery room and were observed there for 1–2 hours until the patients' Ramsey sedation scale returned to level 1. Before recovery room discharge, patients were asked to answer the question "How would you rate your experience with the sedation (or analgesia) you have received during surgery?" using a 7-point Likert-like verbal rating scale (fig. 1). In confused patients and in the dysphasic patient the test was deferred until their ability to express themselves returned to normal level.

Results

Majority of the patients (19 out of 20) were completely satisfied with the anaesthetic management; one patient expressed an unusual feeling about the drilling procedure, which, in the patient's words, continued only for a few seconds. The mean satisfaction score among patients was assessed as 5.8 (ranging from 3 to 7 points). Likewise, the surgeon was asked to rate his satisfaction with patient sedation, using the same method and scale at the end of surgery. The surgeon was completely satisfied with the anaesthesia procedure in terms of patient cooperation, acceptable operation time and absence of intraoperative complications.

Mean hospital stay was 4.5 days (ranging from 3 to 7 days). No medical or surgical and anaesthesia related complications occurred. No patient exhibited intraoperative respiratory depression. One patient died of a complication of the primary disease (Patient no 18) on the 30th postoperative day. All patients resumed their prehaematoma level of function at the time of discharge from hospital. Patients were followed-up for 4–64 months (mean 24.9); in two patients non-symptomatic residual subdural effusion persisted. The rest did well during the follow-up period.

Discussion

In our preliminary study we found that the use of monitored anaesthesia care enhanced patient comfort and surgical competence during the surgical procedure for CSDH. The majority of our patients (19 out of 20) and also the surgeon were satisfied with the anaesthesia procedure. During the surgical procedure no agitation or discomfort in any patient was observed. In the event of cardiac problems and/or significant worsening of hypertension, an additional dose of fentanyl or midazolam was given to ensure surgeon comfort.

At present institutions usually employ general or local anaesthesia for the surgical treatment of CSDH, depending on the medical condition of their patient population and their surgeons' needs. The literature includes reports of large surgically treated CSDH series in which both anaesthesia methods were performed with minor complications [7, 16, 13, 24]. In general, for patients who have coexisting complex systemic disease local anaesthesia is a more favoured method during surgery for CSDH [5, 24]. Other factor in determining the approach to anaesthesia among institutions is the surgical procedure employed. The surgical techniques used for subdural haematoma evacuation vary from twist drill craniostomy to large craniotomy procedures [7, 6]. In our institution we prefer extended burr hole craniotomy for evacuation of subdural haematoma. Local anaesthesia for major procedures for bone removal may sometimes be uncomfortable either for patient or surgeon. General anaesthesia is therefore chosen as the alternative method in these cases, which may occasionally be harmful for patients with associated complex systemic disease. Moreover, general anaesthesia may cause a delay in return to normal levels of consciousness after a procedure that does not permit rapid postoperative neurological examination and often necessitates an urgent radiological evaluation to rule out the need for immediate surgical evaluation.

It is well known that awakening anaesthesia for various neurosurgical procedures is widely used [14]. As a further type of awakening anaesthesia monitored anaesthesia care can be considered the intermediate stage between general and local anaesthesia, and it is also safely employed in neurosurgery practice. Monitored anaesthesia care has the potential for a deeper level of sedation than that provided by sedation/analgesia, and is always administered by an anesthesiologist. The anesthesiologist's continuous attention is directed at optimising patient comfort and safety. Conceptually, monitored anaesthesia care is attractive because it involves less physiological disturbance and allows more rapid recovery than general anaesthesia [11].

Conscious sedation using monitored anaesthesia care can provide a clinical spectrum from relaxation to moderate anaesthesia [11]. The standards for preoperative evaluation, intraoperative monitoring and the continuous presence of a member of the anaesthesia care team are no different from those for general or regional anaesthesia [11, 26]. A significant advantage of this care is easy modification of the procedure from sedation to general anaesthesia when needed [26]. During the procedure frequent changes in the depth of sedation/anaesthesia are needed to prevent complications such as excessive pain or respiratory depression. An alert and cooperative patient is essential for adequate functional testing. A comprehensive preanesthetic evaluation is a critical component of any monitored anaesthesia care procedure. This is especially important because the patient population that presents for monitored anaesthesia care has increasingly complex coexisting disease. There is significant interpatient variability in response to sedative drug administration. The safe provision of monitored anaesthesia care therefore demands the immediate possibility of securing and maintaining a patient airway and performing advanced life support techniques. The degree of noxious stimulation varies during surgical procedure, requiring frequent adjustments in the depth of sedation and analgesia. Thus, sedation techniques should be modified to account for interpatient differences in age, general medical condition and particular requirements of the procedure. In general it is preferable to use drugs with a shorter duration of action to facilitate titration, earlier awakening and a rapid return to normal life.

The combination of midazolam and fentanyl is frequently used as part of monitored anaesthesia care [2]. Some authors note that this combination could cause intraoperative respiratory depression [23], which we did not encounter in our patient population. To prevent this complication low-dose ketamine is suggested in combination with midazolam instead of fentanyl [6].

In our initial experience, we have found shorter operative times compared with our previous cases, in which surgery was performed under general anaesthesia. However, due to insufficient retrospective data and also the small number of the cases, we could not obtain statistical analysis. It is obvious that shorter operative times are beneficial to patients, decreasing the risks of thromboembolism, hypothermia, and intraoperative adverse events. Moreover, we have also found that less total bupivacain infusion is needed in conjunction with monitored anaesthesia care. Although it is more rarely encountered, high doses of local anaesthetic may cause adverse systemic effects in elderly patients. By using monitored anaesthesia care these side effects may be diminished or prevented. One limitation of the present study is the lack of any comparative group with a different anaesthesia (local or general) method. Another potential criticism is the low number of patients.

The greater part of older CSDH patients usually present with systemic disorders. Patients over 60 years of age are prone to diseases such as diabetes mellitus and cardiopulmonary co-morbidities with several associated complications [6–8, 16, 20, 21]. In large CSDH surgery series the incidence of morbidity and mortality was reported as 20–38% and 1–8.3% respectively, in patients with existing systemic disease who had been operated on under local or general anaesthesia [6, 7, 11, 13, 14, 16, 18].

No report can be found in the literature concerning the surgical treatment of CSDH under MAC. On the other hand, MAC has been used for several surgical procedures such as cataract, colonoscopy and liposuction with almost no complications arising from the anaesthesia procedure [1, 2, 26]. Although most of our patients (15 out of 20) had systemic diseases such as hypertension, chronic obstructive pulmonary disease or diabetes mellitus, we did not encounter any problems related to accompanying disease or possibly arising from the anaesthesia method in the intra- and early postoperative period. Given the limited number of patients who were admitted to our hospital with CSDH, we did not have the chance to compare our MAC results with other anaesthesia methods. Even so, when comparing ours with the series in the literature that were performed under other anaesthesia methods, MAC seems safer in elderly CSDH patients.

Airway control may be a major problem in MAC, as intraoperative switchover to general anaesthesia includes a time-consuming intubation and interruption of surgery during a critical phase. In our study, in the event of an airway problem the use of naloxane as an antagonist of fentanyl and flumazenil to reverse midazolam was planned as the initial step [3, 10, 22, 19, 28]. Airway complications did not occur in our series and we encountered no other anaesthesia-related problems.

In conclusion, our preliminary experience suggests that monitored anaesthesia care with the combination of small dose midazolam and fentanyl provides adequate sedation and analgesia, plus a high degree of patient comfort in CSDH surgery procedures. In individuals who present with CSDH and also coexisting complex systemic diseases, monitored anaesthesia care can be safely employed and the patients' perceived risks of general anaesthesia are avoided. Nonetheless, further studies with large series are needed to confirm the safety and also suitability of MAC in CSDH patients and to compare the results of this method with those of other anaesthesia procedures.

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References

1 Akcaboy ZN, Akcaboy EY, Albayrak D, Altinoren B, Dikmen B, Gogus N. Can remifentanil be a better choice than propofol for colonoscopy during monitored anesthesia care? Acta Anaesthesiol Scand. 2006;50:736–41.
2 Alhashemi JA. Dexmedetomidine vs midazolam for monitored anaesthesia care during cataract surgery. Br J Anaesth. 2006;96: 722–6.
3 Coda BA. Opioids. In Barash PG, Cullen BF, Stoelting RK, eds. Clinical Anesthesia. Fifth edition, Lippincott Williams and Wilkins, Philadelphia, 2006:353–83.
4 De Jonghe B, Cook D, Appere-De-Vecchi, Guyatt G, Meade M, Outin H. Using and understanding sedation scoring systems: a systematic review. Intensive Care Med. 2000;26:275–85.
5 Deng XM, Xiao WJ, Luo MP, Tang GZ, Xu KL. The use of midazolam and small-dose ketamine for sedation and analgesia during local anesthesia. Anesth Analg. 2001;93:1174–7.
6 Ernestus RI, Beldzinski P, Lanfermann H, Klug N. Chronic subdural hematoma: surgical treatment and outcome in 104 patients. Surg Neurol. 1997;48:220–5.
7 Erol FS, Topsakal C, Faik Ozveren M, Kaplan M, Tiftikci MT. Irrigation vs. closed drainage in the treatment of chronic subdural hematoma. J Clin Neurosci. 2005;12:261–3.
8 Gelabert-González M, Iglesias-Pais M, García-Allut A, Martínez-Rumbo R. Chronic subdural haematoma: surgical treatment and outcome in 1000 cases. Clin Neurol Neurosurg. 2005;107:223–9.
9 Gurelik M, Aslan A, Gurelik B, Ozum U, Karadag O, Kars HZ. A safe and effective method for treatment of chronic subdural haematoma. Can J Neurol Sci. 2007;34:84–7.
10 Hillier SC, Mazurek MS. Monitored anesthesia care. In Barash PG, Cullen BF, Stoelting RK, eds. Clinical Anesthesia. Fifth edition, Lippincott Williams and Wilkins, Philadelphia, 2006: 1246–61.

11 Horn EM, Feiz-Erfan I, Bristol RE, Spetzler RF, Harrington TR. Bedside twist drill craniostomy for chronic subdural hematoma: a comparative study. Surg Neurol. 2006;65:150–3.
12 Karabinis A, Mandragos K, Stergiopoulos S, Komnos A, Soukup J, Speelberg B, et al. Safety and efficacy of analgesia-based sedation with remifentanil versus standard hypnotic-based regimes in intensive care unit patients with brain injuries: a randomized, controlled trial. Crit Care. 2004;8:268–80.
13 Lee JY, Ebel H, Ernestus RI, Klug N.Various surgical treatments of chronic subdural hematoma and outcome in 172 patients: is membranectomy necessary? Surg Neurol. 2004;61:523–7.
14 Manninen PH, Balki M, Lukitto K, Bernstein M. Patient satisfaction with awake craniotomy for tumor surgery: a comparison of remifentanil and fentanyl in conjuction with propofol. Anesth Analg. 2006;102:237–42.
15 Markwalder TM, Steinsiepe KF, Rohner M, Reichenbach W, Markwalder H. The course of chronic subdural hematomas after burr-hole craniostomy and closed-system drainage. J Neurosurg 1981;55:390–6.
16 Mori K, Maeda M. Surgical treatment of chronic subdural hematoma in 500 consecutive cases: clinical characteristics, surgical outcome, complications, and recurrence rate. Neurol Med Chir. (Tokyo). 2001;41:371–81.
17 Muzii VF, Bistazzoni S, Zalaffi A, Carangelo B, Mariottini A, Palma L. Chronic subdural hematoma: comparison of two surgical techniques. Preliminary results of a prospective randomized study. 1-J Neurosurg Sci. 2005;49:41–6.
18 Okada Y, Akai T, Okamoto K, Iida T, Takata H, Iizuka H. A comparative study of the treatment of chronic subdural hematoma: burr-hole drainage versus burr-hole irrigation. Surg Neurol. 2002;57:405–9.
19 Olkkola KT, Ahonen J. Midazolam and other benzodiazepines. Handb Exp Pharmacol 2008;182:335–60.
20 Osswald PM, Meier C, Schmegg B, Hartung HJ. Complications of anesthesia in elderly patients. Anaesthesist. 1987;36:292–300 (Abstract-Pumed, Article in German).
21 Pearse RM, Rhodes A, Grounds RM. Clinical review: how to optimize management of high-risk surgical patients. Crit Care. 2004;8:503–7.
22 Purdell-Lewis JG. Studies on fentanyl-supplemented anaesthesia: effect on naloxone on the circulation and respiration. Can Anaesth Soc J. 1980;27:323–30.
23 Ramsay MA, Savege TM, Simpson BR, Goodwin R. Controlled sedation with alphaxalone-alphadolone. BMJ. 1974;2:656–9.
24 Rohde V, Graf G, Hassler W. Complications of burr-hole craniostomy and closed-system drainage for chronic subdural hematomas: a retrospective analysis of 376 patients. Neurosurg Rev. 2002;25:89–94.
25 Savoia G, Loreto M, Gravino E, Canfora G, Frangiosa A, Cortesano P, et al. Monitored anesthesia care and loco-regional anesthesia. Minerva Anesthesiol. 2005;71:539–42.
26 Scarborough DA, Herron JB, Khan A, Bisaccia E. Experience with more than 5000 cases in which monitored anesthesia care was used for liposuction surgery. Aesth Plast Surg. 2004;27:474–80.
27 Stefanutto T, Ruttmann T. Conscious sedation v. monitored anesthesia care – 20 years in the South African context. S Afr Med J. 2006;96:1252–4.
28 White PF, Romero G. Nonopioid intravenous anesthesia. In Barash PG, Cullen BF, Stoelting RK, eds. Clinical Anesthesia. Fifth edition, Lippincott Williams and Wilkins, Philadelphia, 2006:334–52.

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