EFFECT OF NEBULIZED LIGNOCAINE ON PREVENTION OF POSTOPERATIVE SORE THROAT FOLLOWING LAPAROSCOPIC CHOLECYSTECTOMY

Ashis Ratna Bajracharya, Gautam Ratna Bajracharya, Chitra Thapa, Sabin Bhandari

Department of Anesthesia, Nepal Medical College and Teaching Hospital, Attarkhel, Gokarneshwor-8, Kathmandu, Nepal

ABSTRACT

Post-operative sore throat (POST) is one of the common side effects of general anesthesia with endotracheal intubation. Several medications have been tried for the prevention of POST. Nebulized lignocaine is easily available, easily administered, cost-effective, and acts immediately with a short duration of action and minimal systemic effects with no long-term residual effects. We conducted this study to find the prevalence of POST when preoperative nebulization with 2% lignocaine is used in patients following laparoscopic cholecystectomy. We also studied the factors associated with POST. This study was done in 100 patients who underwent laparoscopic cholecystectomy and received preoperative lignocaine nebulization. The incidence of POST was measured at 0, 6, 12, and 24 hours postoperatively and various risk factors that might have predisposed for the development of POST were also studied. The mean age of the patients was 42.53±12.82 years. A total of 40 patients (40.0%) experienced POST at any time point during the study period. The majority of patients had mild i.e. Grade 1 POST (11-21%). Patients with a BMI > 30 kg/m^2, CL grade 4, high cuff volume, airway trauma, higher duration of intubation, and higher pneumoperitoneum duration had a greater incidence of POST at all post-operative periods. We concluded that nebulization of 5 ml of 2.0% lignocaine decreases the intensity and treatment requirement for POST and has minimal side effects. A higher incidence of POST is seen in patients who had a higher CL grading, higher BMI, high cuff volume, airway trauma, higher duration of intubation, and longer pneumoperitoneum duration.

KEYWORDS

Laparoscopic cholecystectomy, lignocaine, nebulization, post-operative sore throat

***Received on**: January 10, 2024*
***Accepted for publication**: April 24, 2024*

CORRESPONDING AUTHOR

Dr. Ashis Ratna Bajracharya
Lecturer,
Department of Anesthesia,
Nepal Medical College and Teaching Hospital,
Attarkhel, Gokarneshwor-8, Kathmandu, Nepal
Email: ashis84@hotmail.com
Orcid No: https://orcid.org/0009-0003-0960-2956
DOI: https://doi.org/10.3126/nmcj.v26i2.67206

INTRODUCTION

Postoperative sore throat (POST) is one of the common side effects of general anesthesia with endotracheal intubation. The incidence of POST can vary from 14.4 to 81.0%.[1-3] The postulated etiology of POST is the mechanical injury that occurs during intubation, damage to the mucosa due to the pressure from the endotracheal tube (ETT) cuff, and dehydration of the mucosa.[4,5] A number of predisposing factors have been identified such as the size of the endotracheal tube used, cuff pressure, female sex, duration of anesthesia, surgical positioning, and aggressive oropharyngeal suctioning.[6] It has been found that choice of laryngoscope whether Macintosh laryngoscope or Glide Scope also influences the incidence and intensity of POST.[3]

If tracheal intubation is required, different intubating techniques and drugs have been used prophylactically to alleviate POST.[4] The application of lignocaine gel on the endotracheal tube is widely used for the prevention of POST.[7] But some studies found when lidocaine is applied as a spray or lubricant before intubation, the incidence of sore throat increases rather than decreases.[8,9]

Nebulization is a safe and easy route of drug administration. When nebulized, lidocaine acts locally in oral as well as pharyngotracheal areas and has been used to treat intractable cough as well as asthma and for instrumentation of the upper airway with very less side effects.[10-12] Nebulized lignocaine acts immediately, reaches up to the lower airway, has minimal systemic side effects, and has no long-term residual effects.[13] Various studies have found lignocaine nebulization to be effective in preventing and reducing the severity of POST following endotracheal intubation.[13,14] We conducted this study to determine the incidence of POST in patients undergoing laparoscopic cholecystectomy, nebulized with lignocaine before intubation.

METHODS AND MATERIALS

This observational study was conducted from August 2021 to February 2022 in the post-anesthesia care unit (PACU) of Nepal Medical College Teaching Hospital after approval from the Institutional Review Committee (Ref. No.: 014-078/079). Among all the patients who underwent laparoscopic cholecystectomy under general anesthesia with endotracheal intubation, only the patients who were more than 18 years and received preoperative 2.0% lignocaine nebulization were included in the study. The required sample size for the study was calculated assuming the risk of POST to be 50.0% as no study assessing POST in the Nepalese population undergoing laparoscopic cholecystectomy has been conducted to our knowledge. For a 95.0% confidence interval and 10% error margin, the required minimum sample size was 97 patients. However, we included 100 patients. Patient's preanesthetic assessment forms were reviewed and if the patient had a history of preoperative sore throat, hoarseness, or recent upper respiratory tract infection, recent use of the nonsteroidal anti-inflammatory drug or steroids, if pregnant or lactating were excluded from the study. Informed written consent was obtained from all the patients who met the inclusion criteria.

In the PACU patients were observed for the first 24 hours. Data collection was done by a senior anesthetic resident on duty and included anesthesia record review and patient interview. From the anesthesia record, the patient's Cormack Lehane grade, airway trauma if present at the time of laryngoscopy or extubation, duration of pneumoperitoneum, and total duration of intubation were obtained. The time of admission to the PACU was marked as the beginning of the 24-hour observation period. Patients were interviewed for the presence and absence of POST immediately on arrival at PACU (0 hour), at the 6th hour, 12th hour, and 24th hour. Postoperative sore throat was said to be present if the patient had pain or discomfort or both during swallowing. If the presence of POST was reported, patients were asked to grade its severity on a 4-point scale (0-3) as per the Edmonton Symptom assessment system index in which 0 = no sore throat; 1 = mild sore throat; (patient complains of sore throat only when asked); 2 = moderate sore throat (complains of sore throat on his/her own); 3 = severe sore throat (change in voice or hoarseness associated with throat pain).[15] The POST with a severity of more than 1 was treated as per our hospital treatment protocol.

In this study, airway trauma was said to be present if blood was seen on the airway instruments at any time during laryngoscopy and extubation. The mean value of the volume of air injected in the endotracheal tube cuff was calculated. Those who had a cuff volume higher than the mean value were grouped as high cuff volume and those who had a cuff volume lower than the mean value were considered to have low cuff volume. Duration of pneumoperitoneum was taken as the time from insufflation to release of CO_2. A mean value for the duration of pneumoperitoneum was derived. If the duration of pneumoperitoneum

was less than the mean it was considered short and if the duration of pneumoperitoneum was more than the mean it was considered long. Similarly, total intubation duration was considered as the time from intubation till patients were extubated. A mean value of total intubation duration was calculated. The intubation duration was said to be short if the duration was less than the mean value and long if the duration was higher than the mean value. Descriptive statistics were performed. Quantitative data were expressed as the mean ± SD, and qualitative data were expressed as absolute frequencies (number) and relative frequencies (percentage).

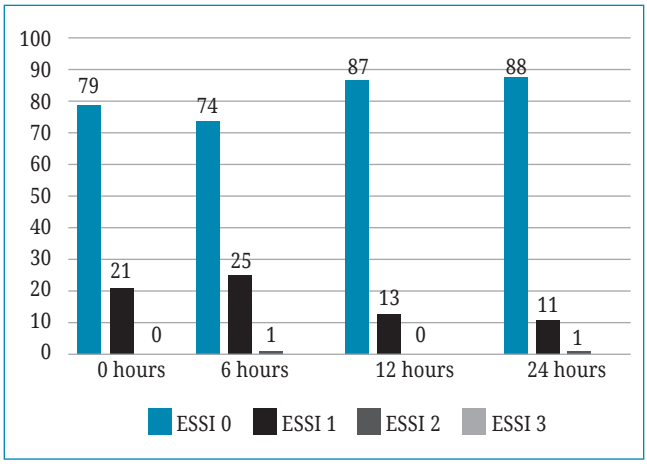

Fig. 1: Severity of POST in various post-operative periods.

RESULTS

A total of 100 patients were included over the study period. Patient characteristics are presented in Table 1.

A total of 40 patients (40.0%) experienced POST at any time during the study period. The incidence of POST was highest at the 6th postoperative hour. There was a decline in the incidence of POST at the 12th and 24th postoperative hour. Of those who experienced POST, the majority of patients had mild i.e. Grade 1 POST (11.0-21.0%) which spontaneously resolved with time. Only one patient had grade II post and none of the patients experienced grade III POST (Fig. 1).

Table 1: Patient characteristics

Age (Mean±SD)	**42.53 ±12.82 years**
Female	80
Male	20
BMI (Mean±SD)	26.14±3.99
BMI	
< 18.5 (Underweight)	4
18.5 – 25 (Normal)	38
25 – 30 (Overweight)	37
>30 (Obese)	21

The incidence of POST at 0 and 6 hours is similar in both sexes. However, a greater percentage of females had POST at 12 and 24 postoperative hours compared to male patients.

Considering BMI and POST, the incidence of POST increased with increasing BMI with the greatest incidence seen among patients with BMI >30kg/m^2. Among patients who had BMI> 30kg/m^2, 23.8% experienced POST at 24 hours while patients with BMI less than 18 had no POST at 24 hours and only one experienced POST at 0 and 6 hours postoperatively (Table 3).

Table 2: Prevalence of POST in relation to sex at 0, 6, 12, and 24 hours postoperative period

	POST0	POST6	POST12	POST24
F = 80	17 (21.25%)	20 (25%)	12 (15%)	12 (15%)
M = 20	4 (20%)	6 (30%)	1 (5%)	0
Total	**21**	**26**	**13**	**12**

Table 3: Prevalence of POST in relation to BMI at 0, 6, 12, and 24 hours postoperative period

	POST0	POST6	POST12	POST24
Underweight	1/4(25%)	1/4(25%)	0	0
Normal weight	6/38 (15.78%)	9/38(23.68%)	3/38 (7.98%)	3/38 (7.98%)
Overweight	7/37 (18.91%)	9/37 (24.32%)	5/37 (13.52%)	4/37 (10.81%)
Obese	7/21 (33.33%)	7/21 (33.33%)	5/21 (23.8%)	5/21 (23.8%)

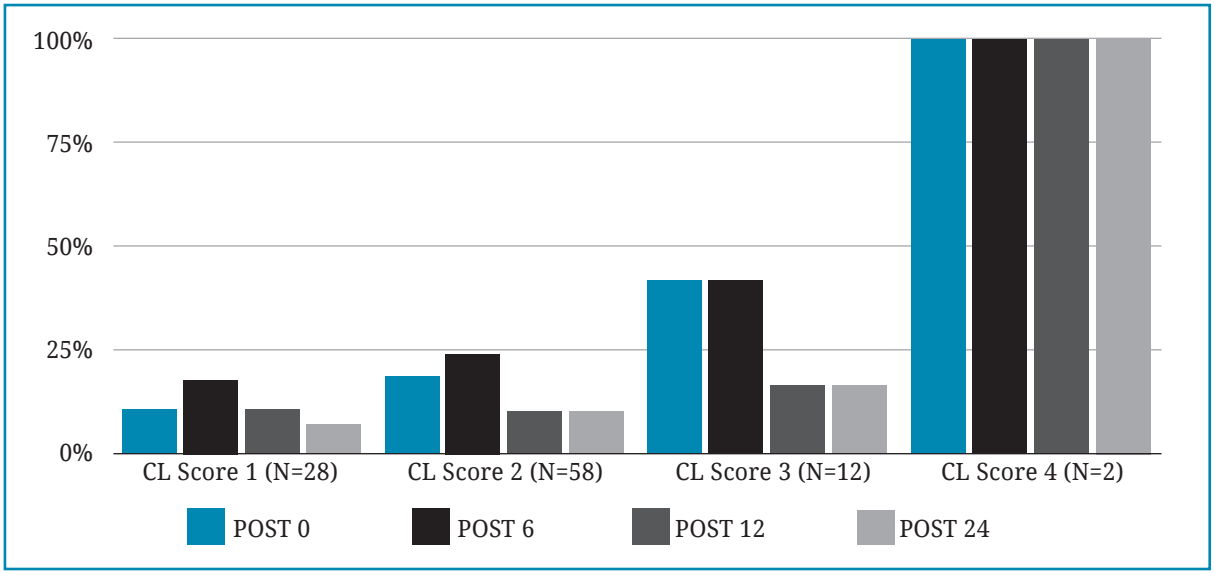

Fig. 2: Occurrence of POST in relation to CL score.

Table 4: Prevalence of POST with various intra-operative factors

	POST0	POST6	POST12	POST24
Cuff volume				
High (>mean)	19/57 (33.33%)	19/57 (33.33%)	8/57 (14.03%)	8/57 (14.03%)
Low (<mean)	2/43 (4.65%)	7/43 (16.2%)	5/43 (11.62%)	4/43 (9.3%)
Airway trauma				
No (83)	17/83 (20.48%)	21/83 (25.3%)	9/83 (10.84%)	7/83 (8.43%)
Yes (17)	4/17 (23.5%)	5/17 (29.41%)	4/17 (23.5%)	5/17 (29.41%)
Total intubation duration				
Long (>mean)	10/43 (23.25%)	12/43 (27.9%)	6/43 (13.95%)	7/43 (16.24%)
Short (<mean)	11/57 (19.29%)	14/57 (24.56%)	7/57 (12.28%)	5/57 (8.77%)
Pneumoperitoneum duration				
Long (>mean)	10/43 (23.25%)	12/43 (27.9%)	6/43 (13.95%)	7/43 (16.24%)
Short (<mean)	11/57 (19.29%)	14/57 (24.56%)	7/57 (12.28%)	5/57(8.77%)

All the patients with CL grade 4 had POST at 0, 6, 12, and 24 hours' postoperative period. Whereas patients who had CL-1, had lesser POST (Fig. 2). In addition, the incidence of POST was higher among those with high cuff volume (more than the mean cut-off) at all postoperative periods (Table 4).

Concerning airway trauma, 9/83 patients (10.84%) and 7/83 (8.43%) without airway trauma and 4/17 (23.5%) and 5/17 (29.41%) with airway trauma experienced POST at 12 and 24 hours postoperative period respectively.

Intubation duration was considered high when it was above average duration of intubation and low when it was less than average duration of intubation. As high as 51.5% of patients with longer duration of intubation had POST as compared to only 5.9% with short intubation periods.

The mean pneumoperitoneum duration among patients undergoing laparoscopic cholecystectomy was 41.23±22.28 minutes. The occurrence of POST was higher in patients with longer pneumoperitoneum duration. POST at 24 hours among patients with pneumoperitoneum duration of more than 41.23 minutes was 16.24% compared to 8.77% whose duration was less than the mentioned time period (Table 4).

DISCUSSION

POST is one of the most typical side effects of endotracheal intubation. Thus, patients who have undergone surgery under general anesthesia with endotracheal intubation may experience postoperative sore throat as a consequence.[14] Postoperative sore throat results in delayed oral intake and patient dissatisfaction, and also affects patients' well-being after surgery in the immediate postoperative period.[16] A total of 40 patients (40.0%) experienced POST during the study period. Among the 40 patients who had POST most of them had grade I POST. None of the patients developed grade III POST. The prevalence of POST increased in 6th postoperative hour and then decreased in 12th and 24th hour respectively. In contrast to a study done by Kamel *et al*,[17] the incidence of sore throat in our study decreased as time passed. In their study, patients had epidural analgesia for postoperative pain while we used intravenous analgesics. The systemic effect of intravenous analgesic might have resulted in a lower POST in our study. Excessively large tube, cuff shape, cuff pressure, and airway securement are some of the major factors that might cause a sore throat after surgery.[18]

Development of POST might be due to several mechanisms such as mucosal trauma, erosion, or irritation.[14] In a study done by Monroe *et al*,[19] the incidence of sore throat in patients in whom blood was present on the airway instruments at any time during laryngoscope and the suction catheter was 64.5% compared with 30.9% with no blood, which suggests that pharyngeal trauma is a significant factor in postoperative sore throat. In our study the incidence was only 23.5% in patients with airway trauma as compared to 20.48% in patients without airway trauma. It suggests that though the incidence of sore throat increases when there is trauma to the airway mucosa during laryngoscopy and suctioning, this incidence can be reduced by preoperative lignocaine nebulization.

The ETT cuff pressure rises significantly in laparoscopic cholecystectomy after the creation of pneumoperitoneum, which might lead to further damage in tracheal mucosa resulting in POST.[20–22] As no control group was present in our study, this comparison could not be made. However, the incidence of POST was only slightly higher among the patients with longer periods of pneumoperitoneum which might be due to preoperative lignocaine nebulization.

Lidocaine is readily available for preoperative nebulization and is relatively cost-effective with minimal side effects.[17] As compared to placebo, Lidocaine has a greater POST preventive effect for 2-3 hours following surgery. (OR: 0.35, 95% credible interval [CrI], 0.16-0.79).[23] A study done by Tanaka *et al*[14] found that the risk of POST was reduced significantly by both systemic and topical lidocaine therapy. (risk ratio (RR) 0.58; 95% confidence interval (CI) 0.41 to 0.82). A possible mechanism for the reduction in the incidence of postoperative sore throat in patients given nebulized lignocaine prior to surgery might be due to the suppression of excitation of airway sensory C fibers or reduced release of sensory neuropeptides such as tachykinins that are involved in bronchoconstriction.[24] Similarly, nebulized or topical lidocaine also leads to the attenuation of pressure response to laryngoscopy and intubation and during anesthesia.[25] Topical anesthesia in the form of nebulization (4 mL of 2% lignocaine) facilitated the distribution of local anesthetic to the pharynx, epiglottis, larynx, and trachea as evident by successful awake fiber-optic intubation.[26]

Our study has several limitations. It was a single-centric study done in a smaller sample size with no comparison group. Due to the nature of the study, we could not find an association between POST and various surgical or anesthetic risk factors.

In conclusion, nebulization with Lignocaine at the dose of 100 mg when used pre-intubation decreases the intensity and treatment requirement for POST without any major complications. A higher incidence of POST is seen in patients who had a higher CL grading, higher BMI, high cuff volume, airway trauma, higher duration of intubation, and longer pneumoperitoneum duration.

Conflict of interest: None

Source of research fund: None

REFERENCES

1. Christensen AM, Willemoes-Larsen H, Lundby L, Jakobsen KB. Postoperative throat complaints after tracheal intubation. *Br J Anaesth* 1994; 73: 786-87. doi:10.1093/bja/73.6.786.
2. Lee JY, Sim WS, Kim ES *et al*. Incidence and risk factors of postoperative sore throat after endotracheal intubation in Korean patients. *J Int Med Res* 2017; 45: 744-52. doi:10.1177/0300060516687227.
3. Najafi A, Imani F, Makarem J *et al*. Postoperative sore throat after laryngoscopy with macintosh or glide scope video laryngoscope blade in normal airway patients. *Anesth Pain Med* 2014; 4: e15136. doi:10.5812/aapm.15136.

4. El-Boghdadly K, Bailey CR, Wiles MD. Postoperative sore throat: a systematic review. *Anaesthesia* 2016; 71: 706-17. doi:10.1111/anae.13438.
5. McHardy FE, Chung F. Postoperative sore throat: cause, prevention and treatment. *Anaesthesia* 1999; 54: 444-53. doi:10.1046/j.1365-2044.1999.00780.x.
6. Agarwal A, Nath SS, Goswami D. An evaluation of the efficacy of aspirin and benzydamine hydrochloride gargle for attenuating postoperative sore throat. *Anesth Analg* 2006; 103: 1001-3.
7. Fayyaz A, Furqan A, Ammar A, Akhtar R. Comparing the effectiveness of betamethasone gel with lidocaine gel local application on endotracheal tube in preventing post-operative sore throat (POST). *J Pak Med Assoc* 2017; 67: 873-6. https://www.ncbi.nlm.nih.gov/pubmed/28585585.
8. Herlevsen P, Bredahl C, Hindsholm K, Kruhøffer PK. Prophylactic laryngo-tracheal aerosolized lidocaine against postoperative sore throat. *Acta Anaesthesiol Scand* 1992; 36: 505-7. doi:10.1111/j.1399-6576.1992.tb03507.x.
9. Loeser EA, Stanley TH, Jordan W, Machin R. Postoperative sore throat: influence of tracheal tube lubrication versus cuff design. *Can Anaesth Soc J* 1980; 27: 156-8. doi:10.1007/BF03007779.
10. Truesdale K, Jurdi A. Nebulized lidocaine in the treatment of intractable cough. *Am J Hosp Palliat Care* 2013; 30: 587-9. doi:10.1177/1049909112458577.
11. Slaton RM, Thomas RH, Mbathi JW. Evidence for therapeutic uses of nebulized lidocaine in the treatment of intractable cough and asthma. *Ann Pharmacother* 2013; 47: 578-85. doi:10.1345/aph.1R573.
12. Chinn WM, Zavala DC, Ambre J. Plasma levels of lidocaine following nebulized aerosol administration. *Chest* 1977; 71: 346-8. doi:10.1378/chest.71.3.346.
13. Rao TR, Subrahmanyam C, Parmar A, Patil S. Effect of nebulized lignocaine for the treatment of post-operative sore throat. *Int J Sci Stud* 2015; 3: 10-3.
14. Tanaka Y, Nakayama T, Nishimori M, Sato Y, Furuya H. Lidocaine for preventing postoperative sore throat. *Cochrane Database Syst Rev* 2009; 3: CD004081. doi:10.1002/14651858.CD004081.pub2.
15. Bruera E, Kuehn N, Miller MJ, Selmser P, Macmillan K. The Edmonton Symptom Assessment System (ESAS): a simple method for the assessment of palliative care patients. *J Palliat Care* 1991; 7: 6-9. https://www.ncbi.nlm.nih.gov/pubmed/1714502.
16. Miskovic A, Johnson M, Frost L, Fernandez E, Pistorio A, Disma N. A prospective observational cohort study on the incidence of postoperative sore throat in the pediatric population. *Paediatr Anaesth* 2019; 29: 1179-85. doi:10.1111/pan.13757.
17. Kamel AAF, Ibrahem Amin OA. The effect of preoperative nebulized: magnesium sulfate versus lidocaine on the prevention of post-intubation sore throat. *Egypt J Anaesth* 2020; 36: 1-6. doi:10.1080/11101849.2020.1723330.
18. Yu J, Ren L, Min S, Yang Y, Lv F. Nebulized pharmacological agents for preventing postoperative sore throat: a systematic review and network meta-analysis. *PLoS One* 2020; 15: e0237174. doi:10.1371/journal.pone.0237174.
19. Monroe MC, Gravenstein N, Saga-Rumley S. Postoperative sore throat: effect of oropharyngeal airway in orotracheally intubated patients. *Anesth Analg* 1990; 70: 512-6. doi:10.1213/00000539-199005000-00008.
20. Lakhe G, Sharma SM. Evaluation of endotracheal tube cuff pressure in laparoscopic cholecystectomy and Postoperative Sore Throat. *J Nepal Health Res Counc* 2018; 15: 282-5. doi:10.3126/jnhrc.v15i3.18856.
21. Wu CY, Yeh YC, Wang MC, Lai CH, Fan SZ. Changes in endotracheal tube cuff pressure during laparoscopic surgery in head-up or head-down position. *BMC Anesthesiol* 2014; 14: 75. doi:10.1186/1471-2253-14-75.
22. Yildirim ZB, Uzunkoy A, Cigdem A, Ganidagli S, Ozgonul A. Changes in cuff pressure of endotracheal tube during laparoscopic and open abdominal surgery. *Surg Endosc* 2012; 26: 398-401. doi:10.1007/s00464-011-1886-8.
23. Wang G, Qi Y, Wu L, Jiang G. Comparative efficacy of 6 topical pharmacological agents for preventive interventions of postoperative sore throat after tracheal intubation: a systematic review and network meta-analysis. *Anesth Analg* 2021; 133: 58-67. doi:10.1213/ANE.0000000000005521.
24. Solway J, Leff AR. Sensory neuropeptides and airway function. *J Appl Physiol* 1991; 71: 2077-87. doi:10.1152/jappl.1991.71.6.2077
25. Mostafa SM, Murthy BV, Barrett PJ, McHugh P. Comparison of the effects of topical lignocaine spray applied before or after induction of anaesthesia on the pressor response to direct laryngoscopy and intubation. *Eur J Anaesthesiol* 1999; 16: 7-10. doi:10.1046/j.1365-2346.1999.00410.x
26. Techanivate A, Leelanukrom R, Prapongsena P, Terachinda D. Effectiveness of mouthpiece nebulization and nasal swab stick packing for topical anesthesia in awake fiberoptic nasotracheal intubation. *J Med Assoc Thai* 2007; 90: 2063-2071. https://www.ncbi.nlm.nih.gov/pubmed/18041425