ORIGINAL ARTICLES

PHILIPPINE JOURNAL OF OTOLARYNGOLOGY-HEAD AND NECK SURGERY VOL. 35 NO. 2 JULY – DECEMBER 2020

Assessment of Nasal Airflow and Pain, Safety and Cost of an Improvised Nasal Airway (Nasogastric) Tube After Endoscopic Sinus Surgery

Josephine Grace C. Rojo, MD
Rachel Zita H. Ramos, MD

Department of Otorhinolaryngology
Head and Neck Surgery
Corazon Locsin Montelibano Memorial Regional Hospital

ABSTRACT

Objective: To compare subjective nasal airflow and overall pain score (as well as safety and added cost of) using an improvised nasal airway tube (nasogastric tube) versus nasal packing after endoscopic sinus surgery (ESS) for chronic rhinosinusitis with nasal polyposis (CRSwNP).

Methods:

Design: Quasi - Experimental Prospective Cohort Study

Setting: Tertiary Government Training Hospital

Participants: Twenty-six (26) consecutive patients aged 18 to 77 years old diagnosed with CRSwNP who underwent ESS were alternately assigned to an experimental group (A) of 13, where an improvised nasal airway (nasogastric) tube was placed in addition to the nasal pack or a control group (B) of 13 with nasal packing alone.

Results: There was a significant difference in subjective nasal airflow between experimental (A) and control (B) groups during the immediate postoperative period where the mean subjective airflow was 8.07 and 0.00 over 10.00, respectively. No significant difference was noted between the groups in terms of age, gender, severity of polyposis and overall pain score. No complications such as bleeding, Toxic Shock Syndrome, vestibular or alar injury and septal necrosis were noted immediately post-op and after one week follow-up in both groups. An approximate cost of PhP 25 was added to group A.

Conclusion: An improvised nasal airway using a nasogastric tube provides adequate airflow without additional pain in the immediate postoperative period. It is safe to use and an affordable option for patients in need of nasal airway stents residing in areas where a preformed nasal packing with incorporated tube stent is not available.

Keywords: *endoscopic sinus surgery; chronic sinusitis; nasal polyps; nasal obstruction; subjective nasal airflow; nasal stents*

Chronic rhinosinusitis (CRS) is an inflammatory disorder of the nasal and paranasal sinuses that lasts for more than 12 consecutive weeks, with the precise pathophysiology still remaining unclear.[1] Despite multifactorial etiology and classifications, and whether allergic or non-allergic, a common denominator is inflammation.[2] Inflammation is the common pathway explaining

Correspondence: Dr. Rachel Zita H. Ramos
Department of Otorhinolaryngology
Head and Neck Surgery
Corazon Locsin Montelibano Memorial Regional Hospital
Lacson cor. Burgos Sts., Bacolod City, Negros Occidental 6100
Philippines
Phone: (632) 917 722 9704, (632) 917 310 8694/
+63 34 703 1350
E-mail: gratcheia@yahoo.com

The authors declared that this represents original material that is not being considered for publication or has not been published or accepted for publication elsewhere in full or in part, in print or electronic media; that the requirements for authorship have been met by all the authors, and that each author believes that the manuscript represents honest work.

Disclosures: The authors signed a disclosure that there are no financial or other (including personal) relationships, intellectual passion, political or religious beliefs, and institutional affiliations that might lead to a conflict of interest.

Presented at the Philippine Society of Otolaryngology Head and Neck Surgery Analytical Research Contest. December 7, 2019. Palawan Ballroom, Edsa Shangri La Hotel, Mandaluyong City.

signs and symptoms of chronic sinusitis. These include facial pain or pressure, nasal congestion or blockade, nasal discharge, and anosmia or hyposmia as common symptoms prompting consult.[1]

The more severe forms of CRS are those with nasal polyposis (CRSwNP) making the previously mentioned symptoms even worse. Standard surgical management for cases refractory to medical management is endoscopic sinus surgery (ESS) that may involve polypectomy, antrostomy, turbinectomy, ethmoidectomy and opening or enlargement of various sinus ostia, as indicated.[3] Nasal packing is frequently applied postoperatively to aid hemostasis and provide structural support to the recently operated sinonasal cavity especially for those with severe nasal polyposis and advanced sinonasal disease where post-operative bleeding is expected. Commercially prepared nasal dressings are widely avaliable, but many do not allow nasal respiration while the pack is in place. There are preformed nasal packs with incorporated stents, but they are in scarce supply and costly especially for indigent populations (such as in the area where this study was conducted).

We postulate that an alternative, low-cost and safe improvised nasal stent can provide immediate relief and a nasal airway that are otherwise sacrificed by nasal packing alone in areas where the preformed nasal pack with stent is not available or too costly. We aim to compare the immediate overall pain score and subjective nasal airflow among patients following ESS for CRSwNP using an improvised nasal airway tube (nasogastric tube) versus nasal packing alone. We further aim to evaluate safety as defined by absence of complications (like intractable bleeding, vestibular or alar injury and septal necrosis) and added cost of this innovation.

METHODS

With approval of the Corazon Locsin Montelibano Memorial Regional Hospital Research Ethical Review Committee (CLMMRH-RERC-2018-18), all patients aged 18 years and above that were diagnosed with CRSwNP and consented to undergo ESS and participate in this study between January and August 2019 were serially considered for inclusion.

Primary recruitment and screening of study participants were done in the outpatient department (OPD). Excluded were those who were pregnant, of foreign nationality and ethnicity, or had bilateral grade 0 to grade II polyposis not requiring nasal packing for hemostasis and structural support and on whom small non-absorbable or absorbable middle meatal spacers would be applied post-operatively without packs.

A quasi-experimental comparative design with alternate assignment to two groups, experimental (A) and control (B) was employed. Consecutive participants were alternately assigned to each group to ensure equal distribution of numbers. Since this was a procedural study, no blinding was done.

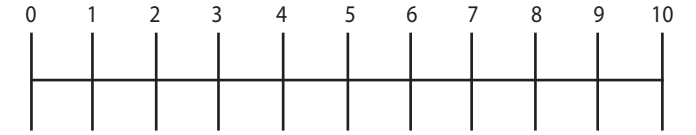
Both groups underwent a pretest for the two dependent variables, (1) Pain Score and (2) Subjective Nasal Airflow. A 2-item survey questionnaire with established visual analog scale (VAS) were used to collect the data. The items were written in both English and in the vernacular. The VAS comprised a 10-cm line with the extremes in pain for item 1 and degree of nasal obstruction-airflow on item 2. *(Figure 1)* The same questionnaire was used on three occasions: 1. one day before surgery when the patient was admitted to the ward; 2. the morning after surgery while the patient was still admitted prior to discharge; and 3. approximately 5-7 days post-operatively during the first out-

Pain and Airflow Visual Analog Scale Assessment Form

Code:_____ Control Number:_____
Diagnosis: _____ Age/Sex: _____
Date of Surgery _____ Date survey taken:_____

1. In a scale of 0-10, zero as no pain and 10 as worst pain, what is the degree of discomfort on nasal area that you feel right now?

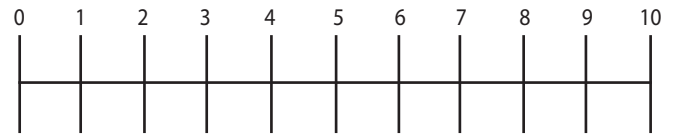
Sa iskala sang 0-10, 0 bilang wala gid sang nga sakit kag 10 bilang inidi maagwantahan nga sakit, ano ang imo ginabatyag nga kasakit?



No pain — *Tawhay/Wala gid sang sakit*
Moderate pain — *Medyo may sakit*
Worst Possible Pain — *Inidi maagwanta nga kasakit*

2. After a maximum nasal inhalation with mouth closed, in a scale of 0-10, zero as nose feels completely blocked with no air entry and 10 as nose feels clear with full air entry, how is the air entry in your nose?

Pagkatapos magginhawa sang todo paagi sa ilong samtang sarado ang baba, sa iskala sang 0-10, 0 bilang wala hangin nga makalusot kag 10 bilang ang tanan nga hangin makalusot sa ilong nga wala sang ga-bara, ano ang pamatyag sang pagsulod sang hangin sa imo nga ilong?



No nasal airflow — *Wala hangin nga makalusot sa ilong*
Full nasal airflow — *Makalusot ang hangin sa ilong nga wala sang ga-bara*

Figure 1. Pain and airflow assessment using modified visual analog scale

patient follow-up for removal of the nasal pack at the OPD. The survey questionnaire was administered first by first and second year residents on duty and confirmed by accompanying third and fourth year residents excluding the primary investigator. The residents were oriented by the primary investigator prior to initiation of the study.

Standard operating procedures were observed for all patients. Surgeons varied but the same pre-operative preparation, surgical technique and anesthesia care were used. The groups only differed in the application of improvised nasal airway tube after ESS. Standard commercially available polyvinyl alcohol (PVA) coated nasal packs (Merocel® Medtronic Inc., Minneapolis, MN, USA) were placed as a middle meatal spacer. In the experimental group, the improvised nasal airway was placed in the nasal floor just below the nasal pack. The improvised airway was constructed from a French 18 nasogastric tube cut according to the length of the nasal airway up to the posterior choanal arch for patients with at least 8mm to 9mm nasal vestibule width. For those with nasal vestibule 5-7mm in size, a 6mm diameter nasogastric tube French 16 was used. The tubes were secured to each other anterior to the columella using Silk-0 suture with a cutting needle, tied over gauze. *(Figure 2)* The control group (B) had only the standard nasal pack inserted.

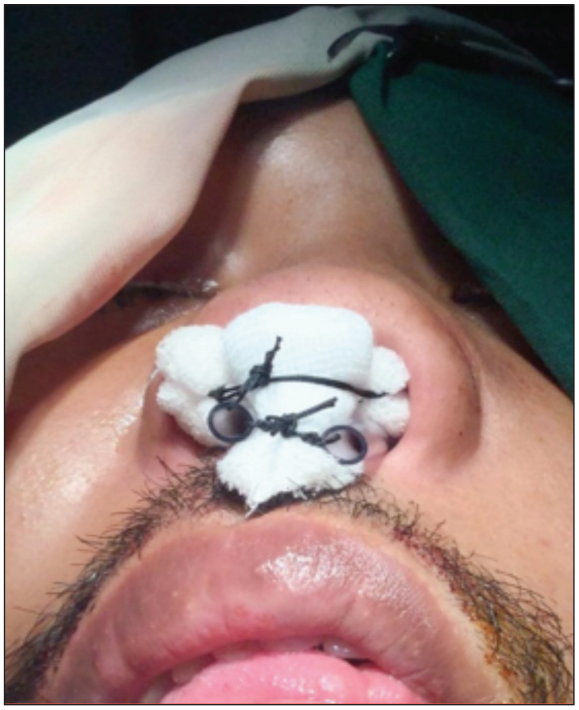


Figure 2. Cut-NGT nasal airways in place, secured with Silk-0 sutures

Post-tests were administered the morning after the procedure. Another assessment was made during the first postoperative follow-up period after removal of the nasal pack (including removal of airway tube for group A). Data including age, gender, pre-operative diagnosis, grading of nasal polyps for each nostril, surgical procedure, group assignment, improvised airway nasogastric tube size, serial scores for subjective airflow and pain, and complications were recorded.

Data was encoded and processed using SPSS Statistics version 22 (IBM Corp. Armonk, NY, USA). Descriptive statistics (mean and standard deviation) were used for demographic data. Independent t-tests were used to compare the means between two groups. Analysis of Variance was computed at 95% confidence interval; P values < .05 were considered significant.

RESULTS

A total of 26 participants completed the study, 18 males and 8 females, with age range from 18 to 77 years old with a mean age of 45 (SD 3.5). There were 13 in the experimental group (A) with improvised nasal airway tube and nasal packing and 13 in the control group (B) with nasal packing alone without an airway tube. Twenty-three (88.5%) had intranasal polyposis while three (12%) had compounding antrochoanal polyposis. On the right nostril, the degrees of polyposis follow: grade III in 23 (88.5%), grade II in 2 (7.7%) and none in 1 (3.8%). On the left nostril, the degrees of polyposis were as follows: grade III in 23 (88.8%), grade II in 1 (3.8%), and grade I in 2 (7.7%). The procedures performed were: Functional Endoscopic Sinus Surgery (FESS) only for 17 (65.4%), FESS with Caldwell-Luc (C-L) Procedure in 5 (19.2%), FESS, C-L and Submucous Resection (SMR) in 3 (11.5%) and Revision ESS in 1 (3.8%).

For the treatment group (A), subjective nasal airflow scores were 3.69, 8.07 and 9.8 out of 10.00, respectively assessed preoperatively, on postoperative day 1 and postoperative follow-up after removal of the improvised airway tube and nasal pack. Mean pain scores measured on the same days were 0.15, 0.53, and 0.30 out of 10.00, respectively. Mean follow-up and subsequent removal was done in 6.5 days. For the control group (B), subjective nasal airflow scores were 4.15, 0.00, and 9.76 out of 10.00, respectively assessed preoperatively, on postoperative day 1 and postoperative follow-up after removal of the nasal pack. Mean pain scores measured on the same days were 0.00, 0.00, and 0.76 out of 10.00 respectively. Mean follow-up and subsequent removal was done in 6.23 days. *(Table 1)*

At 95% confidence interval, analysis of variance showed no significant difference between groups in terms of age, sex, degree of polyposis, procedure performed, pre-operative and post-operative follow-up pain and subjective nasal airflow scores. The only significant difference (0.5 level of significance) between groups was for subjective nasal airflow assessed immediately the day after the procedure. *(Table 1)* This was still statistically significant at 99% level of confidence (Group A n=13, M = 8.0769, SD 1.60528, SEM .44522; Group B n = 13, M = .0000, SD .00000, SEM .00000).

Within the treatment group A, 10 (77%) used a French 18 NGT while only 3 (23%) used a French 16 NGT. There is no significant difference noted for size of NGT, postoperative day 1 pain and subjective nasal airflow scores. Of the 13 patients in this group, 11 (84.6%) had increased subjective airflow from the preoperative period and immediately post-operatively, 2 patients remained the same and none had lower

postoperative subjective airflow results. *(Table 2)*

Overall, no complications were noted in both groups. All patients were fit for discharge the day following the surgery. There was no accidental dislodgement, aspiration, ingestion, or bleeding reported during application of the tube, while the tube was in place and on tube removal during follow-up.

Table 1. ANOVA at 95% level of Confidence

		Sum of Squares	df	Mean Square	F	Sig.
Age	Between Groups	240.038	1	240.038	.731	.401
	Within Groups	7886.000	24	328.583		
	Total	8126.038	25			
Sex	Between Groups	.154	1	.154	.686	.416
	Within Groups	5.385	24	.224		
	Total	5.538	25			
Polyposis	Between Groups	.346	1	.346	3.600	.070
	Within Groups	2.308	24	.096		
	Total	2.654	25			
Right	Between Groups	.346	1	.346	.857	.364
	Within Groups	9.692	24	.404		
	Total	10.038	25			
Left	Between Groups	.038	1	.038	.115	.737
	Within Groups	8.000	24	.333		
	Total	8.038	25			
Procedure	Between Groups	.154	1	.154	.202	.657
	Within Groups	18.308	24	.763		
	Total	18.462	25			
PreopAirflow	Between Groups	1.385	1	1.385	.171	.683
	Within Groups	194.462	24	8.103		
	Total	195.846	25			
PreopPain	Between Groups	.154	1	.154	1.000	.327
	Within Groups	3.692	24	.154		
	Total	3.846	25			
Postop1Airflow	Between Groups	424.038	1	424.038	329.104	.000
	Within Groups	30.923	24	1.288		
	Total	454.962	25			
Postop1Pain	Between Groups	1.885	1	1.885	2.970	.098
	Within Groups	15.231	24	.635		
	Total	17.115	25			
FollowupAirflow	Between Groups	.038	1	.038	.154	.698
	Within Groups	6.000	24	.250		
	Total	6.038	25			
FollowupPain	Between Groups	1.385	1	1.385	.329	.572
	Within Groups	101.077	24	4.212		
	Total	102.462	25			
DaysRemoved	Between Groups	.615	1	.615	.500	.486
	Within Groups	29.538	24	1.231		
	Total	30.154	25			

Table 2. Subgroup Analysis of Variance for Tube Size and Postoperative Day 1 Pain and Subjective Nasal Airflow

		Sum of Squares	df	Mean Square	F	Sig.
Postop1Airflow	Between Groups	4.523	1	4.523	1.885	.197
	Within Groups	26.400	11	2.400		
	Total	30.923	12			
Postop1Pain	Between Groups	1.131	1	1.131	.882	.368
	Within Groups	14.100	11	1.282		
	Total	15.231	12			

DISCUSSION

An improvised nasal airway using a nasogastric tube provides adequate airflow without additional pain in the immediate postoperative period following ESS for CRSwNP. It is safe to use and affordable. Chronic rhinosinusitis (CRS) is defined as inflammation of the nasal cavity and paranasal sinuses and/or the underlying bone that has been present for at least 12 weeks. It is divided into two subgroups, CRS without Nasal Polyposis (CRS w/o NP) and CRS with Nasal Polyposis (CRS w NP). Nasal polyps are pedunculated masses of edematous inflamed mucosa usually described as smooth, semi-translucent, pearly white to pinkish in color and sometimes resembling a peeled grape appearance and is a major determinant of debilitating symptoms experienced by patients with CRS w NP.[1] The prevalence rate of nasal polyposis in adults in Asia is 1-4% with no predilection in sex, and is noted to occur even less in children.[2] In this study, only adults were assessed and majority of the subjects were males.

Endoscopic sinus surgery (ESS) is the standard of surgical management for CRS refractory to medical management especially for those with CRS w NP. Various other medical management regimes are available to address the many facets of CRS, but nasal obstruction is considered to be one of the most important aspects of the patient's quality of life (QoL) making it a part of many types of QoL assessment forms. Post-operative improvement of nasal obstruction and QoL has been extensively studied, but there is limited data available in the literature as to the degree of nasal airflow assessed immediately postop especially for patients with massive polyposis requiring nasal packing. The degree of relief from nasal obstruction immediately postoperatively was significantly different between groups. All patients in the treatment group A had moderate to high subjective nasal airflow with an average score of 8 over 10 in contrast to those in group B where there was no amount of subjective airflow. Although the absence of nasal airflow may not matter much for patients with long-standing pre-operative subjective airflow close to zero, those who had some degree

of airflow during the preoperative period would be forced to mouth-breathe postoperatively after nasal packing alone fully obstructs the nasal airway. On the other hand, the greater positive difference was marked among patients who had no or limited airflow preoperatively, comparatively experiencing significant improvement during the immediate postoperative period. The majority of patients reporting improved subjective airflow with none reporting worsened airflow after tube placement supports the importance of providing a nasal airway for patients requiring packing after ESS.[1, 3]

A visual analog scale (VAS) used in assessing subjective nasal obstruction or airflow appears to be clinically relevant and may be used in lieu of standard rhinomanometry when the latter is not available. Subjective evaluation of nasal obstruction symptoms significantly correlated with rhinomanometry results in many studies.[4, 5]

Although more comprehensive quality of life (QoL) forms can better assess the overall postoperative improvement brought about by placement of an improvised nasal airway tube, the importance of VAS as an assessment has been previously described in patients who underwent uncinectomy where pre- and post-operative nasal airflow and resistance using rhinomanometry as an objective tool and VAS as a subjective tool were compared.[6] There was no significant difference in pre- and post-uncinectomy rhinomanometry results whereas patients reported significant subjective improvement in nasal airflow, showing that objective rhinomanometric measurements of nasal airflow and resistance may not have direct correlation to subjective sensation of airflow.[6] Because quality of life and subjective perception of comfortable breathing is more important, rhinomanometry has little clinical value, and subjective VAS assessment may be a better option in certain conditions as utilized in this study.

Various nasal packs available include expandable nasal packs made from polyvinyl alcohol (PVA) derived from viscose and cellulose, like Netcell® and Merocel® with the latter utilized in this study. Risks in using nasal packs include pain, discomfort and very rarely, Toxic Shock Syndrome (TSS). However, the probable benefit of reducing hemorrhage justifies the possible risks. The addition of a nasal tube could theoretically increase these risks. However, none of these complications were noted in both groups, supporting the safety of the use of nasal packing with or without addition of an airway tube.[7, 8,9]

Excluding concerns with logistics and stock availability, medical grade preformed nasal packs with built-in airway tubes already exist with an average price of PhP 1,750 per piece or PhP 3,500 for both nostrils.[10] This price was compared with the no-thread Merocel® used in this study costing PhP 250 per piece or PhP 500 for both nostrils plus PhP125 for the silk suture used to anchor and tie the nasal pack and PhP 25 for the NGT, for a maximum total of PhP 650 and a difference of PhP 2,850 per patient utilizing these postoperatively.[10] This savings, together with the marked improvement in subjective nasal airflow and safety profile are positive factors that can be considered for patients with limited resources or residing in areas where the preformed nasal pack with built-in tube is not available.

There are several limitations to this study. First, the limited number of respondents. Second, the absence of another comparative group using the commercially available nasal pack with built-in tube and lastly, the absence of an objective nasal airway assessment tool. Future studies may improve the process of randomization, utilize a validated questionnaire, or previously-translated and validated QoL questionnaires such as SNOT -22, to assess other facets of postoperative patients' outcome. Other measures like total operative time can be included in the overall analysis of cost and device utility can be studied in other diseases requiring postoperative nasal packing such as obstructive sleep apnea of sinonasal etiology.

In conclusion, the use of an improvised nasal airway tube during the immediate postoperative period markedly improves subjective nasal airflow in patients requiring bilateral nasal packing for structural and hemostatic support after endoscopic sinus surgery for CRSwNP. Application of this tube does not cause any added pain compared to those who only have nasal packing alone. Furthermore, using a standard NGT as an improvised nasal airway tube is safe and affordable and may be considered for patients with limited resources and in areas where a preformed nasal airway with built-in tube is not available.

ACKNOWLEDGEMENTS

The authors acknowledge the valuable general concept applied in this study as practiced and suggested by Dr. Jose L. Montilla III.

REFERENCES

1. Rimmer J, Fokkens WJ, Chong LY, Hopkins C. Surgical versus medical interventions for chronic rhinusinusitis with nasal polyps. *Cochrane Database Syst Rev.* 2014 Dec; (12): CD0006991. DOI: 10.1002/14651858.CD006991.pub2; PubMed PMID: 25437000.
2. Tikaram A, Prepageran N. Asian nasal polyps: a separate entity. *Med J Malaysia.* 2013 Dec; 68(6):445-7. PubMed PMID: 24632910.
3. Stölzel K, Bandelier M, Szczepek A, Olze H, Dommerich S. Effects of surgical treatment of hypertrophic turbinates on the nasal obstruction and the quality of life in patients with chronic rhinosinusitis. *Am J Otolaryngol.* 2017 Nov-Dec;38(6):668-672. DOI: 10.1016/j.amjoto.2017.08.009. PubMed PMID: 28877858.
4. Ciprandi G, Mora F, Cassano M, Gallina AM, Mora R. Visual analog scale (VAS) and nasal obstruction in persistent allergic rhinitis. *Otolaryngol Head Neck Surg.* 2009 Oct; 141(4):527-9. DOI: 10.1016/j.otohns.2009.06.083; PubMed PMID: 19786224.
5. Hsu HC, Tan CD, Chang CW, Chu CW, Chiu YC, Pan CJ, et al. Evaluation of nasal patency by visual analogue scale/nasal obstruction symptom evaluation questionnaires and anterior active rhinomanometry after septoplasty: a retrospective one-year follow-up cohort study. *Clin Otolaryngol.* 2017 Feb; 42(1):53-59. DOI: 10.1111/coa.12662; PubMed PMID: 27102375.
6. Yaniv E, Hadar T, Shvero J, Raveh E. Objective and subjective nasal airflow. *Am J Otolaryngol.* Jan-Feb 1997;18(1):29-32. DOI: 10.1016/s0196-0709(97)90045-4; PubMed PMID: 9006674.
7. Weber RK. Nasal Packing and Stenting. *GMS Curr Top Otorhinolaryngol Head Neck Surg.* 2009;8:Doc02. DOI: 10.3205/cto000054; PubMed PMID: 22073095; PubMed Central PMCID: PMC3199821.
8. Akbari E, Philpott CM, Ostry AJ, Clark A, Javer A. A double-blind randomised controlled trial of gloved versus ungloved merocel middle meatal spacers for endoscopic sinus surgery. *Rhinology 50*: 306-310, 2012. DOI: 10.4193/Rhino11.215.
9. von Schoenberg M, Robinson P, Ryan R. Nasal packing after routine nasal surgery—is it justified? *J Laryngol Otol.* 1993 Oct; 107(10): 902-905. DOI: https://doi.org/10.1017/S0022215100124740. PubMed PMID: 8263386.
10. RBGM Medical Express Sales, Inc. [Website]. Product costs. [cited 2018] Available from: https://rbgm-medical.com/