Mini Review

MINI REVIEW: REVISITING THE KIESSELBACH'S TRIANGLE

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ABSTRACT

Epistaxis is spontaneous or induced bleeding of blood vessels in the nasal cavity. Sixty percent of people suffer from epistaxis in their lifetime occurring most in children and adults due to traumatic injuries and nasal cavity hemangiomas on the Kiesselbachs triangle. Kiesselbachs triangle/Little's area is the inferior anterior quadrant part of the nasal septum just superior to the vestibule of nasal cavity. It's formed by a network/vascular plexus of blood vessels that supply blood to the nasal septum and cavity. These vessels are braches of both internal carotid (anterior and posterior ethmoid arteries) and external carotid (spheno-palatine artery, greater palatine artery, superior labial artery) arterial systems. The mucosa lining epithelia over the plexus consists of proliferating to form columnar cells and mucus forming goblet cells. However this epithelium is too thin, Plexus forming blood vessels are large and the Plexus' location at the nasal cavity's subjects it to extremes of varying environmental conditions such as cold, heat, low and high moisture, eroding trauma putting it at high risk of epistaxis.

Keywords: Epistaxis, Kiesselbachs triangle, Kiesselbachs plexus, Little's area

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INTRODUCTION

Kiesselbachs plexus/triangle also called little's area is an anterior inferiorly quadrant part of the nasal septum immediately superior to the vestibule of the nasal cavity (1). It's a vascular plexus formed by meshwork of blood vessels carrying oxygenated blood to cavity and septum of the nose (1,2). The Plexus forming blood vessels are said to be branches of both internal and external carotid arterial system (1–3).

Kiesselbachs triangle was discovered and first described by a scientist James Lawrence Little in 1879 thus named after him as Little's area (4). It was later comprehended by a German otolaryngologist Wilhelm Kiesselbachs who studied and described further the plexus in 1884 and thus also named after him as Kiesselbachs area, triangle/plexus(5). As of today these names Little's area, Kiesselbach's triangle/plexus are used synonymously. The Little's area is among vital topics in anatomical education while dealing with Head and Neck Anatomy at undergraduate level. However up to date it is one of the most forgotten or neglected topics to be taught by medical educators while teaching undergraduate medical, nurses, anesthesia and paramedical students leaving it to be taught at Masters/Resident students of Ear, Nose and Throat residents(6). Moreover not all the undergraduate students are going to specialize in Ear nose and throat yet they are the available contact health workers at health facilities. More than 60% people experiences epistaxis during their life time with 90% occurring in children and adults commonly due to traumatic injuries, nasal septal hemangiomas (7,8). It is clinically vital for health workers most importantly ear nose and throat surgeons, doctors, nurses and paramedics to in understand the anatomy, etiology and management of epistaxis and nasal tumors from the Kiesselbachs triangle (6,9). Therefore in this article, we revisit the Kiesselbachs triangle to descriptively summarize and simplify its anatomy and clinical relevancy of in medical practice.

STRUCTURE/ARTERIAL SUPPLY OF THE KIESSELBACH'S TRIANGLE

The Kiesselbachs triangle derives its blood supply from internal carotid artery system (ICA) and external carotid artery (ICA) systems (1,10). These give off branches which further branch to form 5 arteries that contribute to the Kiesselbachs plexus. ICA gives of ophthalmic artery that gives off anterior and posterior ethmoidal arteries while ECA gives off maxillary and fascial arteries as seen in figure 1. The maxillary artery branches to form spheno-palatine artery and descending palatine artery that forms greater palatine artery while fascial artery branches to superior labial artery that contributes to the Kiesselbach's plexus through its septal branches as shown in figure 1 and 2 (1,2). The arteries forming this plexus are thin walled and extensively connected with each other. This predisposes them to easy and constant ooze bleeding upon injury shown in figure 2 (11). The blood contributing/forming arteries anastomose and form a triangle like plexus thus derivation of name triangle as seen in figure 2.

VENOUS DRAINAGE AND NERVE SUPPLY OF THE LITTLE'S AREA & NASAL SEPTUM.

Deoxygenated blood from anterior part of nasal septum, mostly the little's area is drained to systemic circulation by veins accompanying arteries forming the plexus. These are facial vein, ophthalmic veins and tributaries of the pterygoid plexus (1,10).

Nerve supply: Motor and sensory innervation is from the nasopalatine nerve and Septal branch of anterior ethmoidal nerve (1,2,10).

EPITHELIA OF NASAL SEPTUM

The nasal cavity has three regions: vestibular, respiratory and olfactory regions. The outermost vestibular mucosa is lined with thick keratinized stratified squamous epithelium and supported by vascular connective tissue containing sebaceous and mucous vestibular glands (11,12). This suddenly transitions to the middle part the respiratory region, the largest among the three (11). The respiratory region mucosa is made of two types of epithelia, the septal respiratory epithelium lining the nasal septum & conchal respiratory epithelium lining nasal cavity conchal (7).

The septal epithelium is made of three cell types; basal cells at the bottom near the basement membrane, ciliated and non-ciliated pseudo stratified columnar epithelia among which numerous goblet cells are embedded, above the basal cells and on the nasal mucosa surface (11,13). Basal cells divide to form columnar and new goblet cells that line the septa mucosa. The goblet cells produce large quantities of mucus that traps foreign bodies and dust particles from entering the lungs and release to the nasopharynx either to swallow or sneeze out (7,11). Secreted mucus may also be a center for mucus membrane defense systems/immunity; goblet cell-derived resistin-like molecule plays a vitally in activating cluster differentiated cells like CD4+ T cells (11,15).

The sub epithelial tissue consists of glandular acini of septal glands and collagen base fibres of loose connective tissue. Epithelia over little's area is thinner unlike other septal parts (12,14).

FUNCTIONS OF THE KIESSELBACH'S AREA/PLEXUS

The little area has the following functions;

a) Provides a blood supply to the nasal septum (11,16).

b) Air conditioning: Since the covering epithelia is very thin as in figure 3, it provides a thin barrier for heat exchange; inhaled air is heated/warmed and humidified for effective gaseous exchange. This heat exchange from the anastomosing arteries to the entering air (11,12,16).

c) Little's area in conjunction with other parts of nasal cavity, acts to perform other functions that include; olfaction, forms passage to respiratory airway, filtering and ciliary mechanism, vocal resonance in sinuses, nasal reflex functions-sneezing (17).

CLINICAL APPLICATION

Epistaxis: This is bleeding from the nose resulting from injury to blood vessels in the nasal cavity which occurs spontaneously or after induction. More than 60% of people experience epistaxis during their life(18), and up to 90% of nasal bleeding occur from Kiesselbachs plexus with children and young adults being the most affected age groups (10). This is because, the vessels are more visible and mucosa is thinner. The little area is made of septa cartilage, blood vessel plexus embedded in the nasal septum mucus making it soft and fragile (4,12). Moreover the arteries in the triangle are larger than capillaries with a thin mucosa predisposing to easily bleeding from trauma as a result of an external blow, heavy nasal blowing, sharp finger nail, nasal cavity dryness (11,12). The types of epistasis include; anterior/spontaneous epistaxis and posterior/hypertensive epistaxis.

1) **Anterior/spontaneous epistaxis:** Bleeding from the anterior nasal septum in the little's area mostly or from anterior inferior turbinate less common (10,19). Usually aggravated by trauma or underlying infection. Usually seen in children and young adults (20). It can be acute & for short time or recurrent depending on the causative pathology involved. Anterior/spontaneous epistaxis is easy to treat, however, they are more likely to re-occur in nasal cavity Hemangiomas (7).

2) **Posterior/hypertensive epistaxis**: Bleeding from any other part of the nasal cavity posterior to anterior nasal septum and anterior inferior turbinate. Mostly occur in the superior posterior part and is highly prevalent in elderly (10).

Acute/non-recurrent epistaxis is treated by long compression of the anterior inferior nasal septum by pinching with head tilt forward or nose packing with cotton wool treated with phenyl epinephrine and lidocane for 10 minutes (20) while persistent and recurrent is by cauterization of the vessels or evaluating and treating the underlying pathology (21).

Nasal cavity hemangiomas/bleeding polypus: A hemangioma is a type of benign/non-cancerous tumor of vascular origin(9,22). It's made of connective tissue and blood vessels due uncontrolled capillary endothelial proliferation commonly affecting the skin, tongue, lips and mucous membranes; oral mucosa and nasal cavity (9,14). The little's area is the most common site for hemangiomas of the nasal cavity. The young population is the highly affected age group with 80% of the nasal hemangiomas occurring mostly at age of 20 years (8). They arise either from the mucosa of the nasal septum or osseous part and their signs and symptoms and surgical treatments differ (9). Mostly present recurrent unilateral or bilateral epistaxis and difficulty in breathing due to nasal cavity obstruction by the tumor (7,14, 20)

Cryotherapy, YAG lesser resection (7), endoscopic excision of hemangiomas(20), Embolism of external carotid artery branches, corticosteroid therapy are some of treatment techniques in treatment of these hemangiomas (25,26).

FACTS ON VULNERABILITY OF THE LITTLE'S AREA

a) The little area location near the nasal cavity vestibular entrance and is prone to extreme environment al conditions like varying temperature from warm to hot or cold and moisture from high and low (2).

b) The mucosa over the septal cartilage is very thin (12).

c) Blood vessels network in the little area are large and thin walled compared to those in other parts that are thick walled as seen in figure 3 (1,11).

References

1. FRANK H. NETTER. ATLAS OF HUMAN ANATOMY [Internet]. 6th ed. Carlos A. G. Machado, John T. Hansen, Brion Benninger, Jennifer Brueckner-Collins, Todd M. Hoagland RST, editor. Philadelphia,: SAUNDERS ELSEVIER; 2014. 642 p. Available from: NetterAppFeedback@elsevier.com
2. Richard L. Drake A. Wayne Vogl and Adam W. M. Mitchell. Gray's anatomy for students 3rd edition [Internet]. 3rd ed. Mitchell RLDAWV and AWM, editor. Church Hill Livingstone: Elsevier; 2014. 1192 p. Available from: email: online.help@elsevier.com
3. Morgan DJ, Kellerman R. Epistaxis: Evaluation and treatment. Prim Care - Clin Off Pract [Internet]. 2014 Mar 1 [cited 2022 Nov 27];41(1):63–73. Available from: http://www.primarycare.theclinics.com/article/S0095454313001036/fulltext
4. Chatzaraki V, Schweitzer W, Thali MJ, Ampanozi G. Nasal Septum Defects Detected on Postmortem Computed Tomography. Am J Forensic Med Pathol [Internet]. 2019;40(3):7. Available from: https://doi.org/10.5167/uzh-171280
5. Tunkel DE, Anne S, Payne SC, Stacey L, Rosenfeld RM, Abramson PJ, et al. Clinical Practice Guideline : Nosebleed (Epistaxis) Executive Summary. David E Tunkel, MD1, Samantha Anne, MD, MS2, Spencer C Payne, MD3, Stacey L Ishman, MD, MPH4, Richard M Rosenfeld, MD, MPH, MBA5, Peter J Abramson, MD6, Jacqueline D Alikhaani7, Margo McKenna Benoit, MD8, Rachel S Bercovitz, MD, MS9, Michael D Bro [Internet]. 2020;162(1):28. Available from: https://doi.org/10.1177/0194599819889955
6. Buja LM. Medical education today : all that glitters is not gold. BMC Med Educ [Internet]. 2019;11. Available from: https://doi.org/10.1186/s12909-019-1535-9
7. Penezic A. Mixed Type Haemangioma of the Inferior Turbinate : A Rare Cause of Epistaxis [Internet]. Vol. 71. 2016. Available from: apangercic@gmail.com 1
8. Walker TW, Macfarlane TV, McGarry GW. The epidemiology and chronobiology of epistaxis: an investigation of Scottish hospital admissions 1995–2004. Clin Otolaryngol. 2007;32:361–5.
9. Nee S, Gendeh THS, Ramzisham BSGAR. The Nasal Hemangioma. Indian J Otolaryngol Head Neck Surg. 2019;71(s3):4.
10. kenhub. Kiesselbach's Plexus: Anatomy, branches, clinical notes | Kenhub [Internet]. Kiesselbach's Plexus: Anatomy, branches, clinical notes | Kenhub.

[cited 2022 Nov 27]. p. 3. Available from: https://www.kenhub.com/en/library/anatomy/kiesselbachs-plexus

11. Yang J, Dai L, Yu Q, Yang Q. Histological and anatomical structure of the nasal cavity of Bama minipigs. PLoS One. 2017;12(3):14.
12. Al-kafagy SM, Reshag AF. HISTOLOGICAL FEATURES OF THE NASAL CAVITY IN INDIGENOUS DOGS. Plant Arch. 2021;20(2):7.
13. Kalan A, Tariq M. Foreign bodies in the nasal cavities: a comprehensive review of the aetiology, diagnostic pointers, and therapeutic measures. Postgr Med J. 2000;76(898):484–7.
14. Cellina M, Gibelli D, Cappella A, Martinenghi C, Belloni E, Oliva G. Nasal cavities and the nasal septum: Anatomical variants and assessment of features with computed tomography. Neuroradiol J [Internet]. 2020;33(4):340–7. Available from: https://journals.sagepub.com/doi/abs/10.1177/1971400920913763
15. Jennische E, Eriksson CE, Lange S, Trybala E, Bergström T. The anterior commissure is a pathway for contralateral spread of herpes simplex virus type 1 after olfactory tract infection. J Neurovirol [Internet]. 2015;21(2):129–47. Available from: https://link.springer.com/article/10.1007/s13365-014-0312-0
16. Sobiesk JL, Munakomi S. Anatomy, Head and Neck, Nasal Cavity. StatPearls [Internet]. 2022 Jul 25 [cited 2022 Nov 27]; Available from: https://www.ncbi.nlm.nih.gov/books/NBK544232/
17. Biadsee A, Gob A, Sowerby L. Anterior epistaxis. CMAJ. 2022 Oct 3;194(38):E1322.
18. Tomkinson A, Roblin DG, Flanagan P, Al. E. Patterns of hospital attendance with epistaxis. Rhinology. 1997;35:3.
19. NCBI. Anatomy, Head and Neck, Nasal Cavity - StatPearls - NCBI Bookshelf [Internet]. Anatomy, Head and Neck, Nasal Cavity - StatPearls - NCBI Bookshelf. [cited 2022 Nov 27]. p. 3. Available from: https://www.ncbi.nlm.nih.gov/books/NBK544232/#_NBK544232_pubdet_
20. Biadsee A, Gob A, Sowerby L. Anterior epistaxis. CMAJ. 2022 Oct 3;194(38):1.
21. Melia L, McGarry GW. Epistaxis: update on management. Curr Opin Otolaryngol Head Neck Surg. 2011;19:30–5.
22. Ahmed MW, Almaghrabi LH, Alshehri WM, Najd A, Mutari SG Al. Case Report Hemangioma of the Nasal Septum in a Middle Aged Female. J Surg Res. 2019;2(1):6.
23. Tunkel DE, Anne S, Payne SC, Ishman SL, Rosenfeld RM, Abramson PJ, et al. Clinical Practice Guideline : Nosebleed (Epistaxis) Executive Summary. Am Acad Otolaryngol Neck Surg Found. 2020;162(1):18.
24. Sethi RKV, Kozin ED, Abt NB, Bergmark R, Gray ST. Treatment disparities in the management of epistaxis in United States emergency departments. Laryngoscope. 2018 Feb 1;128(2):356–62.
25. Tunkel DE, Anne S, Payne SC, Ishman SL, Rosenfeld RM, Abramson PJ, et al. Clinical Practice Guideline: Nosebleed (Epistaxis). Otolaryngol - Head Neck Surg

(United States). 2020 Jan 1;162(1_suppl):S1–38.

26. Kucik CJ, Clenney T. Management of epistaxis. Am Fam Physician. 2005;71:305–11.

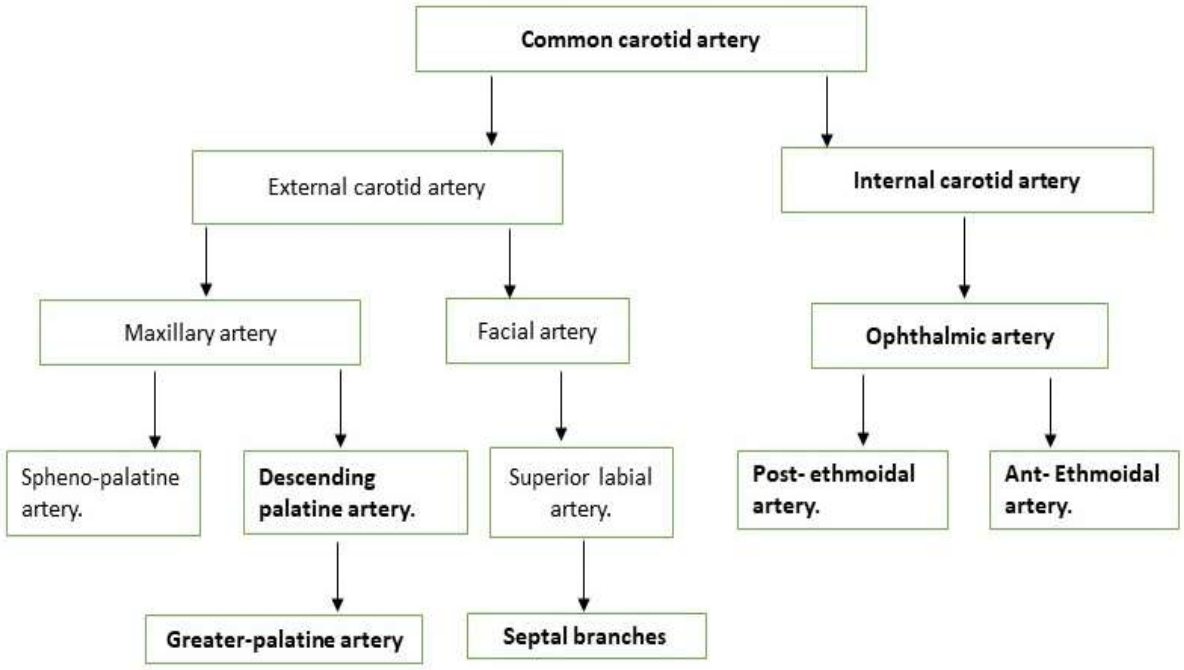

Figure 1: Arterial Composition/supply of the little area.

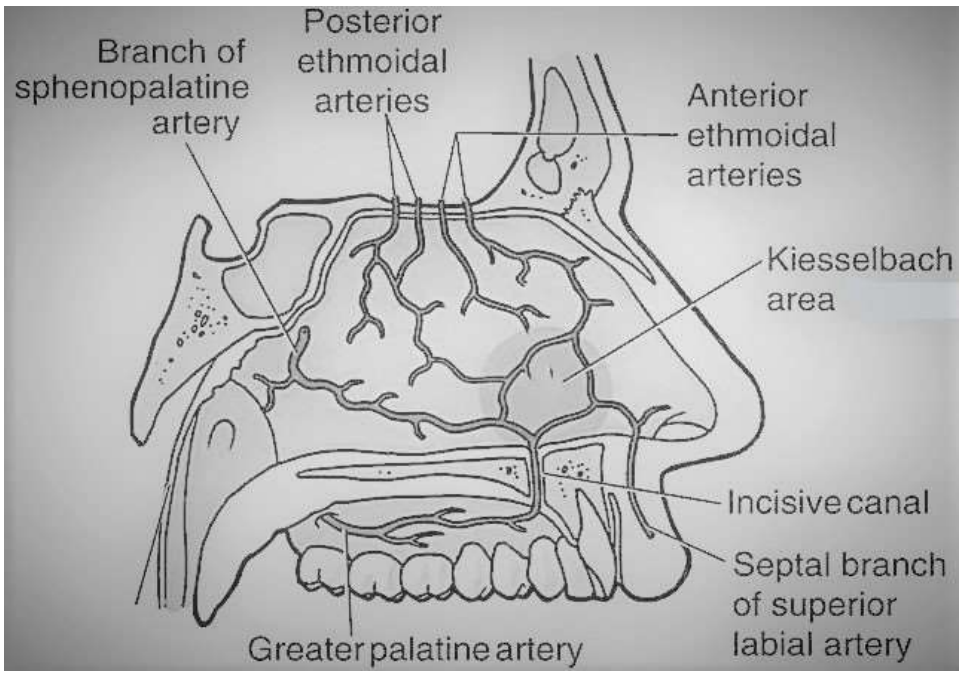

Figure 2: Illustration showing the Kiesselbachs Plexus/Triangle formation

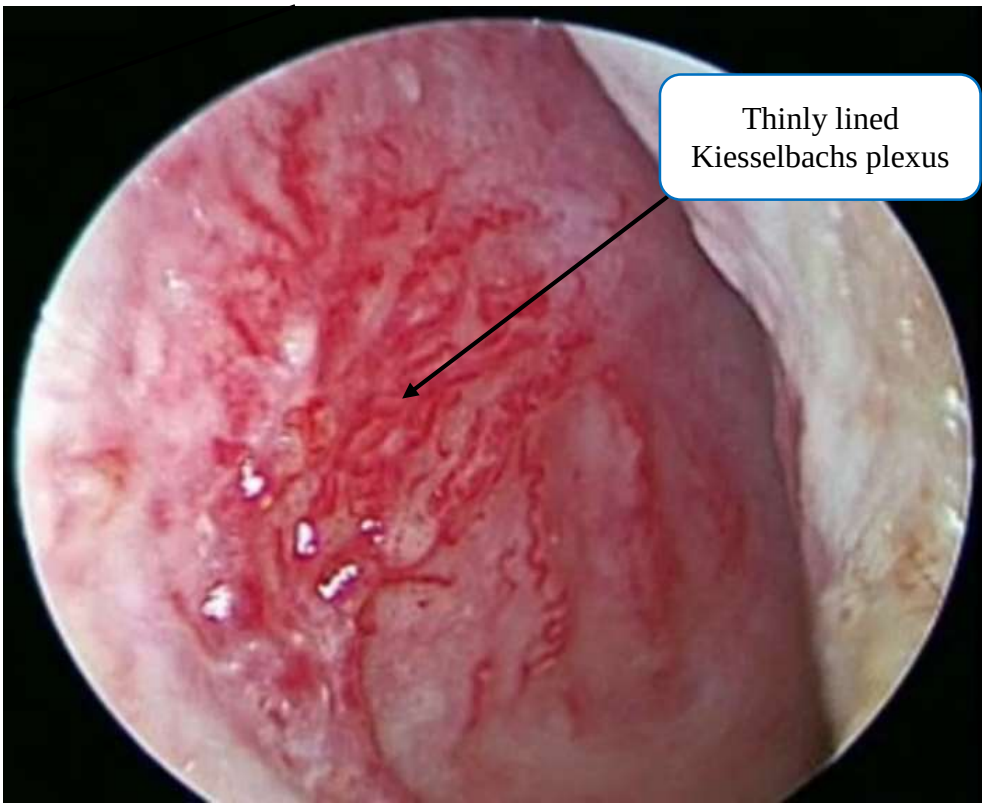

Figure 3: A Rhinoscopic view of the kiesselbach's plexus on the nasal mucosa.