

COMBINED VPT AND NSET IN ACARIOUSLY EXPOSED MATURE PERMANENT TOOTH - A CASE REPORT

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ABSTRACT

It is now understood that the type of diseased status of cariously exposed pulp found in multirooted tooth may vary from one root canal to the other. In contrast to conventional endodontic therapy, this new concept allows for different treatment options such as Vital Pulp Therapy (VPT) for the pulp in non infected root canal/s and Regenerative Endodontic Therapy (RET) or Non-Surgical Endodontic Therapy (NSET) in other root/s with bacterial contamination or pulpal necrosis. Presence of pulp tissue in the root canal helps to maintain proprioception, hydration of tooth, defense mechanism and thus, reducing the propensity to tooth fracture.

This case report illustrates the treatment of a mature mandibular first molar with Symptomatic Irreversible Pulpitis and Apical Periodontitis. Mesial root was treated with VPT and in distal root canals due to time constraints, single sitting NSET was performed instead of RET. A follow up of 12 months was done. The tooth is now asymptomatic, AP has healed, positive response to pulp sensibility test and subserving the normal function.

KEY WORDS

**Symptomatic Irreversible Pulpitis,
Apical Periodontitis, VPT, NSET**

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INTRODUCTION

Historically, the use of Vital pulp Therapy (VPT) for Mature Permanent teeth with Irreversible Pulpitis had been discouraged, with majority recommending pulpectomy¹.

Now-a-days, significant improvement has occurred in the understanding of pulp biology and the responses of the pulp to the carious process; the release of dentin bound growth factors and active molecules such as stem cell factor, insulin like growth factor binding protein, nerve growth factor binding protein, glial cell line - derived neutrophilic factor and transforming growth factor beta-1 has highlighted the fact that pulp in mature teeth has greater regenerative potential than that was previously thought. This improved understanding of pulp biology and the regenerative and healing potential of the inflamed pulp has encouraged the adoption of VPT in properly selected cases². The different procedures for VPT are Indirect Pulp Capping, Direct pulp capping, Partial pulpotomy and Full Pulpotomy.

Full Pulpotomy is defined as “complete removal of coronal portion of the dental pulp, followed by placement of suitable dressing or medicament that will promote healing and preserve vitality of the tooth.” This procedure provides a higher chance of removing the infected and irreversibly inflamed tissue compared to partial pulpotomy. The ability to control bleeding after amputation of the infected pulp tissue has been suggested as the surrogate marker for the degree of inflammation and the healing potential of remaining pulp tissue. This has been proven to be successful using bioactive endodontic cements (MTA, Biodentine, Bioceramics) in young as well as mature permanent teeth³.

Over the years, the diagnosis and classification of pulp diseases have changed and is continuously evolving. An accurate diagnosis of pulp status plays a vital role in selecting the correct treatment option and to achieve a favourable outcome. The present diagnostic tool only suggests the status of pulp as vital or non-vital⁴. Hence, the reversible or irreversible condition of the pulp cannot be decided solely on the basis of clinical signs and symptoms as there is known variation in the degree of

inflammation. Histologically, the carious pulp exposure may exhibit both damaged and healthy pulp at different levels in the root canal and it has been found that in Irreversible Pulpitis, inflammation is confined to the area adjacent to carious exposure, not spreading beyond 2mm from the exposure site^{5,6}. Also, literature has suggested that after the amputation of pulp which has undergone degeneration and irreversible changes, the radicular pulp can be conserved. Hence, based on the concept of spread of inflammation in compartments in multirooted tooth, it may be understood that in one root, there may be no or minimal bacterial invasion while the other root/s would be contaminated which may even cause pulpal necrosis. Therefore, the combination therapy with VPT in the former root while Non Surgical Endodontic Therapy (NSET) in the other/scan be considered. This case report illustrates such combination therapy in a permanent mandibular first molar tooth in which the mesial root was treated with VPT and the distal root with NSET.

CASE HISTORY

A 31 years old female patient presented with a chief complaint of pain in lower left back region of jaw in the OPD of Conservative Dentistry and Endodontics Department of Dr. R. Ahmed Dental College and Hospital, Kolkata. She gave the history of intermittent and lingering pain, which increased on lying down, referring to ear and head region started one month ago. Pain was provoked by chewing or cold liquids. The patient's medical history was non-contributory and she had no known drug allergy.

Clinical examination revealed deep occlusal caries extending to the pulp tissue in relation to tooth #36 (Fig.1A). The tooth exhibited sensitivity to percussion. Periodontal probing were all within normal limits. Radiographic Examination illustrated deep carious lesion involving pulp with widened periodontal space around mesial root and periapical radiolucency around distal root of #36(Fig.1B and 1C). Response to cold test (RoekoEndofrost, Coltene) and Electric Pulp Test (EPT) [Confident dental equipments, India] was exaggerated when compared to adjacent and contralateral similar tooth

(Fig.1D) [same EPT was used throughout the study and gradation of EPT upto 40 is considered normal]. Based on history, clinical and radiographic examination, the diagnosis of Symptomatic Irreversible Pulpitis with Apical Periodontitis was made.

MATERIAL AND METHODS

Informed consent was received from the patient. Clearance from Institutional Ethics Committee was taken. The tooth was anaesthetized using lidocaine 2% with adrenaline 1:80000 (Fig.2A). After isolating the tooth with rubber dam (GDC Dental Dam Kit) (Fig.2B), caries was removed with a low speed sterile round carbide bur and the exposed pulp tissue was severed to the level of canal orifices. After locating the canal orifices, bleeding was assessed (Fig.2C). The colour of bleeding was noted and it was controlled with pressure application using pledget of cotton soaked in 3% NaOCl (Prime Dental Pvt. Ltd.) within 7-8 minutes in mesial canals indicating presence of vital pulp whereas it still persisted even beyond 10 minutes in distal canals indicating deeper penetration of bacteria (Fig.2D). So, it was decided to perform VPT in mesial canals while distal canals were treated with NSET instead of RET as the patient would not be able to visit before 3 months.

After achieving hemostasis, white MTA (MTA, Angelus) of 2-3mm thickness was placed above the mesial canal orifices (Fig.2E) followed by placement of a layer of RMGIC (Fuji II LC, GC dental Int, Leuven, Belgium) over MTA and light cured for 20 seconds (Fig. 2F).

After completing VPT in mesial root, IOPAR was taken (Fig. 2G) and standard single sitting NSET was planned to perform in the canals of distal root with periapical lesion. Inflamed pulp was removed to identify the canal orifices. The working length was determined using an electronic apex locator (Propex Pixi, Dentsply) and confirmed using IOPAR (Fig.2H). The canals were instrumented using #08 to #25K file sequentially and ProTaper Gold Rotary Files (Dentsply Tulsa Dental, Tulsa OK,USA). Final preparation was done till Protaper F3. Entire instrumentation was supplemented with copious

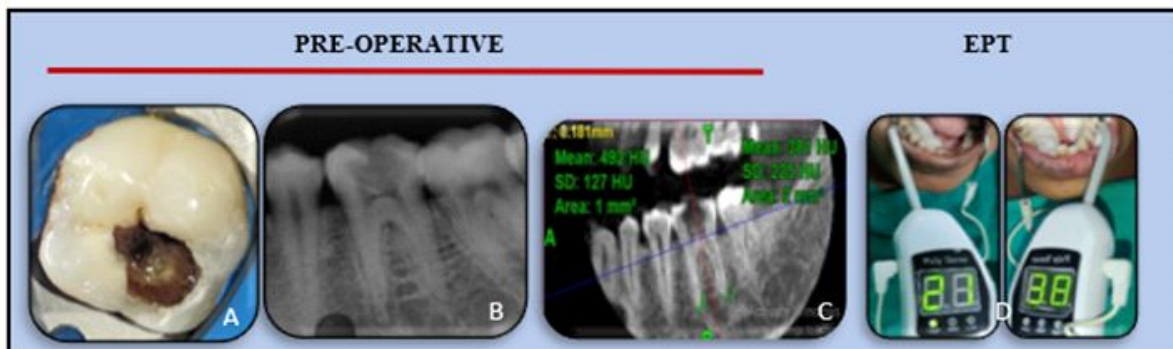


Fig.1 : A.Pre-op clinical photograph, B.Pre-opIOPAR ,C.Pre-opCBCT, D.EPT showing positive response(Reading #46 - 21 and #36 - 38)

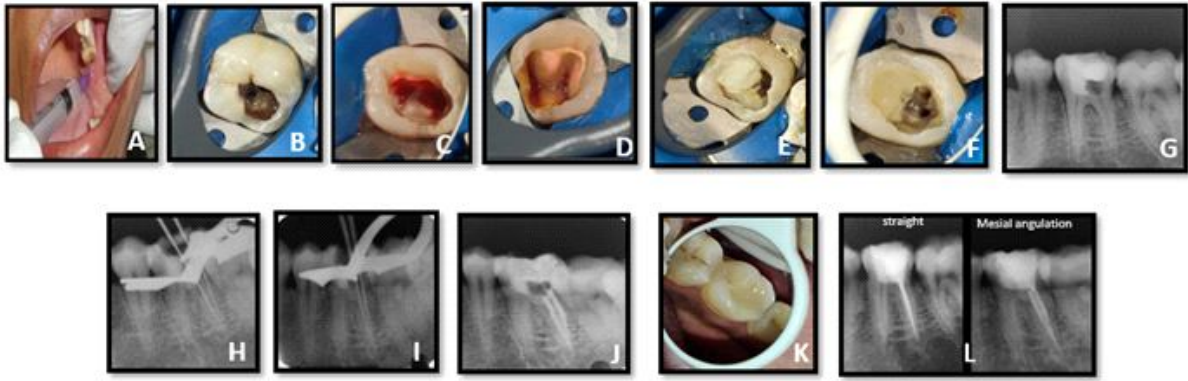


Fig. 2: A Local Anaesthesia administered, B. Rubber Dam isolation, C. Bleeding from access cavity , D. Bleeding arrested in mesial canals and persisted in distal canals E. MTA over mesial canals, F. RMGIC over MTA , G. IOPAR after VPT in mesial canals(X-Ray taken after removing rubber dam clamp and placing temporary restoration within access cavity to prevent contamination), H. IOPAR - Working Length , I. IOPAR - Master Cone , J. IOPAR- Postobturation , K. Restoration with composite resin , L. Imm.Post - op IOPAR (straight and mesial angulation)

irrigation using 5.25% NaOCl with a negative pressure irrigation system. An IOPAR was taken to ensure the fit of master cone (Fig.2I). Before obturation, the canals were irrigated with 17% EDTA (Desmear, Anabond Stedman Pharma Research (P) Ltd.) for 1minute and finally flushed with 5ml normal saline. After the canals were dried using sterile paper points, obturation was done using gutta percha and AH Plus as root canal sealer and a post obturation IOPAR was taken (Fig.2J). The access cavity was sealed with composite resin restoration (Tetric-E-CeramBulk Fill; Ivoclar-Vivadent, Schaan, Liechstein) (Fig.2K) and postoperative radiographs were taken (Fig.2L). Followup was done after 3, 6 and 12 months.

RESULT

The tooth was assessed clinically and radiographically in all follow up visits. The tooth was found to be asymptomatic - no complaint of pain, swelling, draining sinus, sensitivity to hot and cold food substances, non tender to percussion or palpation. Pulp sensitivity test was positive to cold. Readings of EPT were gradually shifting to that of contralateral similar tooth (fig.3A,4A,5A and Table1) indicating gradual reversal of pulpal status to normal. Follow up radiographs (Fig.3B and 3C, 4B and 4C, 5B and 5C) revealed intact lamina dura in mesial root and periapical pathosis indistal root of #36 as evident by gradual elimination of apical radiolucency and increase in bone density (HU) (Table 1).

Evaluation at follow up visits

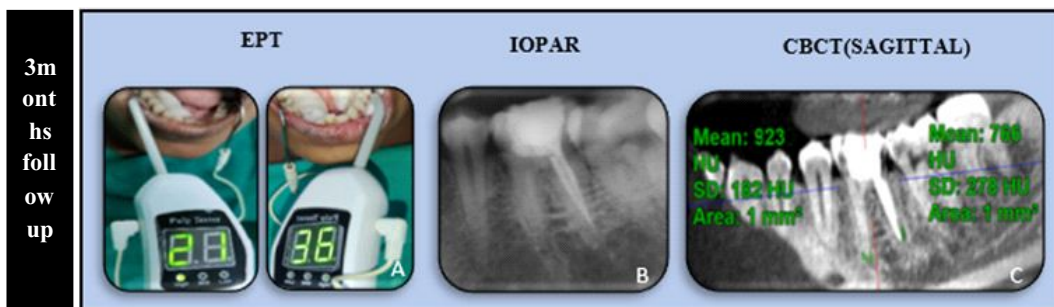


FIG 3

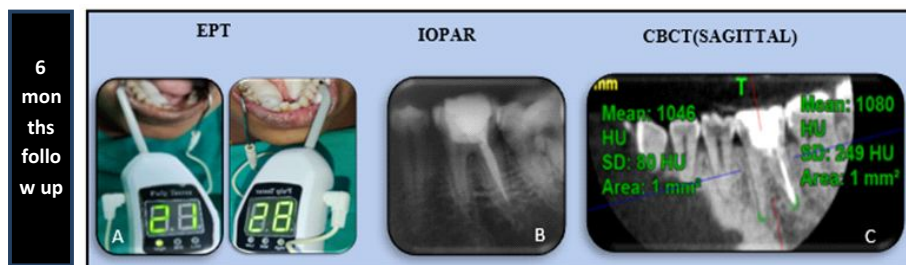


FIG 4

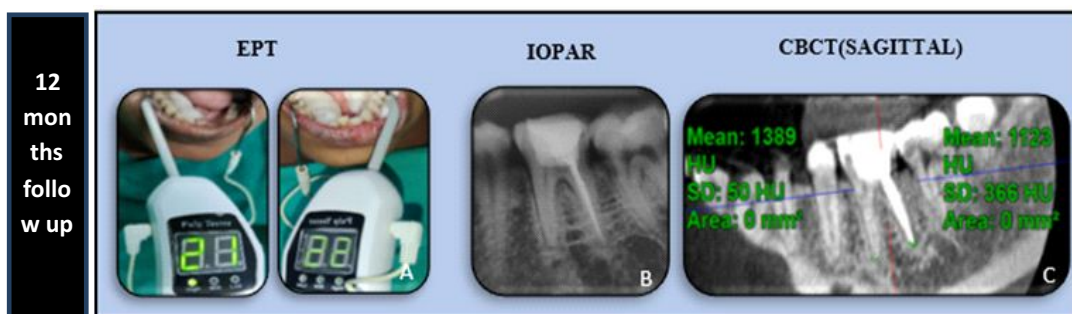


FIG 5

Table 1 : Depicts healing of Apical Periodontitis (gradual elimination of RL & increase of bone density:HU) and gradual reversal of pulpal status to normal as evident by readings of EPT

TIME PERIOD	DISTAL ROOT: RCT		MESIAL ROOT: VPT				
	CBCT: SAGITTAL		CBCT: SAGITTAL		RESPONSE TO COLD TEST	RESPONSE TO ELECTRIC PULP TEST	
	GV(HU)	Area(mm ²)	GV (HU)	Area (mm ²)		C - #46	EXP - #36
Pre-op	381	2	492	1	POSITIVE	21	38
3 mon.	766	1	923	1	POSITIVE	21	36
6 mon.	1080	1	1046	1	POSITIVE	21	28
12 mon.	1123	0	1389	0	POSITIVE	21	22

C – Contralateral Exp. - Experimental

DISCUSSION

The treatment for mature permanent teeth diagnosed with Irreversible Pulpitis has been NSET which is considered as a non-conservative and non-biological treatment as it removes the entire infected and healthy pulp losing its regenerative potential, proprioceptive impulses, nerve innervations and damping properties.⁷

Clinical signs and symptoms of the patient do not reflect the actual extent of inflammation in pulp tissue⁸. According to the study conducted by Baume et al, there is coexistence of different condition in various parts of the same pulp and literature has suggested that after the amputation of pulp which has undergone degeneration and irreversible changes, the radicular pulp can be conserved^{9,10}. Hence, based on this concept, VPT is considered as the preferred option in treating the tooth with irreversible pulpitis.

Bacterial invasion of dental pulp through caries is

a compartmentalized process resulting in a peripheral area of liquefactive pulp tissue with subjacent inflamed tissue next to healthy tissue^{11,12}. Histologically, the pulpal conditions can vary from coronal to radicular areas and also from one root canal to other depending on the extent and location of bacterial intrusion, the time of exposure, and the innate and adaptive defense mechanism^{12,13}. On the basis of varying condition of pulp in a multirooted tooth, treatment can be modified to take advantage of such variations and combined treatment procedures in a multirooted tooth can be considered¹⁴.

Dummer et al found a weak link between clinical symptoms and real histologic condition of pulp¹⁵. On the basis of pulp sensibility testing and clinical signs and symptoms alone, there is no clear dividing point between reversible and irreversible pulpitis¹⁶. In such cases, insitu clinical diagnosis based on the color of pulpal bleeding and the time to arrest bleeding can be considered as an important factor to diagnose the inflammatory state of the pulp¹⁷.

Pulp pathology	<i>In situ</i> discrétion
Reversible pulpitis	Bright red bleeding, medium bleeding that stops after 5 min of hemostasis
Irreversible symptomatic pulpitis	Very abundant cherry red bleeding
Irreversible asymptomatic pulpitis	Low red cherry bleeding and/or fibrous white aspect of the pulp
Necrobiose	Dry root canal/bleeding root canal for the same tooth
Pulp necrosis without apical complication	Dry root canal

Image courtesy Lejri et al¹⁷

In this case, the colour of blood was cherry red which is in accordance with “The in situ classification” given in the study conducted by Lejri et al¹⁷ suggesting the diagnosis as Irreversible Symptomatic pulpitis and according to the study conducted by Aguilar and Linsuwanont, if the bleeding stops within 1-10 minutes, VPT can be performed and if the bleeding cannot be controlled within 1-10 minutes, it suggests that either the inflamed pulp has not been completely removed or the pulpal inflammation has progressed into the radicular pulp. In that case, the treatment procedure should be shifted from pulpotomy to pulpectomy¹⁸. This is why, in this case, VPT was done in mesial root as bleeding could be stopped within 7-8 mins and NSET was performed in the distal root as the bleeding persisted even after 10 mins.

To achieve desired outcomes in VPT, MTA has been suggested as a suitable agent. The literature indicates that MTA can induce growth factors release from the dentin matrix¹⁹. The dentin matrix-associated growth factors can signal mesenchymal stem cells in the pulp to differentiate into odontoblast-like cells and produce dentin bridges²⁰. Thus, the use of appropriate pulpotomy agent (MTA) in the present study has been attributed to the positive outcome. After the removal of superficial inflamed pulp, a favourable environment is set for pulp wound healing to occur²¹. The immunoinflammatory cells gradually reduce with apoptosis. The injured pulp tissue will release chemokines such as stromal-derived factor-1 to attract undifferentiated mesenchymal stem cells to migrate to the wounded site. Thus, giving the remaining radicular vital pulp a chance to heal¹.

In the present case report, it was observed that there was gradual reversal of pulpal status to normal in the radicular pulp of mesial root canal which was treated with VPT,

CONCLUSION

Through this case report, it may be concluded that a mature mandibular molar tooth with Symptomatic Irreversible Pulpitis associated with Apical Periodontitis can be treated with the

combination treatment of Vital Pulp Therapy in one root and Non Surgical Endodontic Therapy in another, as this will give a better chance for the healing of inflamed vital tissue and removal of the diseased tissue simultaneously.”

REFERENCES

1. Asgary Saeed, Eghbal Mohammad Jafar, Ghodduji Jamileh. Two-year results of vital pulp therapy in permanent molars with irreversible pulpitis: an ongoing multicenter randomized clinical trial. *Clin Oral Investig* 2014;18:635–41.
2. Tomson PL, Lumley PJ, Smith AJ, et al. Growth factor release from dentine matrix by pulpcapping agents promotes pulp tissue repair-associated events. *Int Endod J* 2017;50:281–92.
3. Asgary Saeed, Eghbal Mohammad Jafar, Fazlyab Mahta, et al. Five-year results of vital pulp therapy in permanent molars with irreversible pulpitis: a noninferiority multicenter randomized clinical trial. *Clin Oral Investig* 2015;19:335–41.
4. Mejäre IA, Axelsson S, Davidson T, Frisk F, Hakeberg M, Kvist T, Norlund A, Petersson A, Portenier I, Sandberg H, Tranaeus S, Bergenholtz G. Diagnosis of the condition of the dental pulp: a systematic review. *Int Endod J*. 2012 Jul;45(7):597-613. doi: 10.1111/j.1365-2591.2012.02016.x. Epub 2012 Feb 13. PMID: 22329525.
5. Ricucci Domenico, Loghin Simona, Siqueira José F. Correlation between Clinical and Histologic Pulp Diagnoses. *J Endod* 2014;40:1932–9.
6. Seltzer Samuel, Bender I. B., Ziontz Murray. The dynamics of pulp inflammation: 285 Correlations between diagnostic data and actual histologic findings in the pulp. *Oral Surg, Oral Med Oral Pathol* 1963;16:846–71.
7. Wolters W J, Duncan H F, Tomson P L, et al. Minimally invasive endodontics: a new diagnostic system for assessing pulpitis and subsequent treatment needs. *Int Endod J* 2017;50:825–9.
8. Koli B, Chawla A, Logani A, Kumar V, Sharma S, Combination of NonSurgical Endodontic and Vital Pulp Therapy for Management of Mature Permanent Mandibular Molar Teeth with Symptomatic Irreversible Pulpitis and Apical Periodontitis, *Journal of Endodontics (2020)*, doi: <https://doi.org/10.1016/j.joen.2020.10.010>
9. Baume LJ. Diagnosis of diseases of the pulp. *Oral Surg Oral Med Oral Pathol*. 1970 Jan;29(1):102-16. doi: 10.1016/0030-4220(70)90416-0. PMID: 5261896
10. Taha N A, Ahmad M B, Ghanim A. Assessment of Mineral Trioxide Aggregate pulpotomy in mature permanent teeth with carious exposures. *Int Endod J* 2017;50:117–25.

11. Rechenberg DK, Galicia JC, Peters OA. Biological Markers for Pulpal Inflammation: A Systematic Review. *PLoS One*. 2016 Nov 29; 11(11): e0167289. doi: 10.1371/journal.pone.0167289. PMID: 27898727; PMCID: PMC5127562.
12. Zanini M, Meyer E, Simon S. Pulp Inflammation Diagnosis from Clinical to Inflammatory Mediators: A Systematic Review. *J Endod*. 2017 Jul;43(7):1033-1051. doi: 10.1016/j.joen.2017.02.009. Epub 2017 May 17. PMID: 28527838.
13. Hahn CL, Liewehr FR. Relationships between caries bacteria, host responses, and clinical signs and symptoms of pulpitis. *J Endod* 2007;33:213–9.
14. Terauchi Y, Bakland LK, Bogen G, Combined Root Canal Therapies in Multirooted Teeth with Pulpal Disease, *Journal of Endodontics* (2020), doi:https://doi.org/10.1016/j.joen.2020.09.014.
15. Dummer PM, Hicks R, Huws D. Clinical signs and symptoms in pulp disease. *Int Endod J*. 1980 Jan;13(1):27-35. doi: 10.1111/j.1365-2591.1980.tb00834.x. PMID: 6935168.
16. Taha NA, About I, Sedgley CM, Messer HH. Conservative Management of Mature Permanent Teeth with Carious Pulp Exposure. *J Endod*. 2020 Sep; 46(9S): S33 - S41. doi: 10.1016/j.joen.2020.06.025. PMID: 32950193.
17. Lejri W, Douki N, Kallel I. Evaluation of a new means of pulpal diagnosis through a prospective study of 133 cases. *Endodontology* 2019;31:21-4.
18. Aguilar P, Linsuwanont P. Vital pulp therapy in vital permanent teeth with cariously exposed pulp: a systematic review. *J Endod*. 2011 May;37(5):581-7. doi: 10.1016/j.joen.2010.12.004. Epub 2011 Mar 5. PMID: 21496652.
19. Smith A J, Tobias R S, Cassidy N, et al. Odontoblast stimulation in ferrets by dentine matrix components. *Arch Oral Biol* 1994;39:13–22.
20. Lin Louis M, Ricucci Domenico, Saoud Tarek M, et al. Vital pulp therapy of mature permanent teeth with irreversible pulpitis from the perspective of pulp biology. *Aust Endod J* 2020;46:154–66
21. Kumar V, Abbas AK, Aster JC. Robbins and Cotran pathologic basis of disease. 9th ed. Philadelphia: Saunders; 2014.