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Medical Management of the Surgical Patient with Cardiovascular Disorder

Infective Endocarditis

It's a serious life-threating microbial infection of the endothelial lining of the heart and the heart valves. It occurs, in most cases, in proximity to an acquired or congenital heart defect (Little *et.al.*, 2012).

Predisposing conditions associated with infective endocarditis (Little *et.al.*, 2012):

1. Mitral valve prolapse.
2. Aortic valve disease.
3. Congenital heart disease (e.g. patent ductus arteriosus, ventricular septal defect).
4. Prosthetic heart valve.
5. Intravenous drug abuse.
6. Other unknown causes.

Sign and symptom of infective endocarditis (Urbano, 2000):

1. Fever.
2. Heart murmurs.
3. Positive blood cultures for causative microorganisms.
4. Roth's spots: Oval- shaped, white- centered hemorrhages present on the retina.
5. Osler's nodes: Painful, erythematous nodules most commonly found on the pads of the fingers and toes.
6. Janeway lesions: Nontender, erythematous and nodular lesions most commonly found on the palms and soles.
7. Splinter haemorrhages: Small, linear hemorrhages under the nails that are usually asymptomatic.

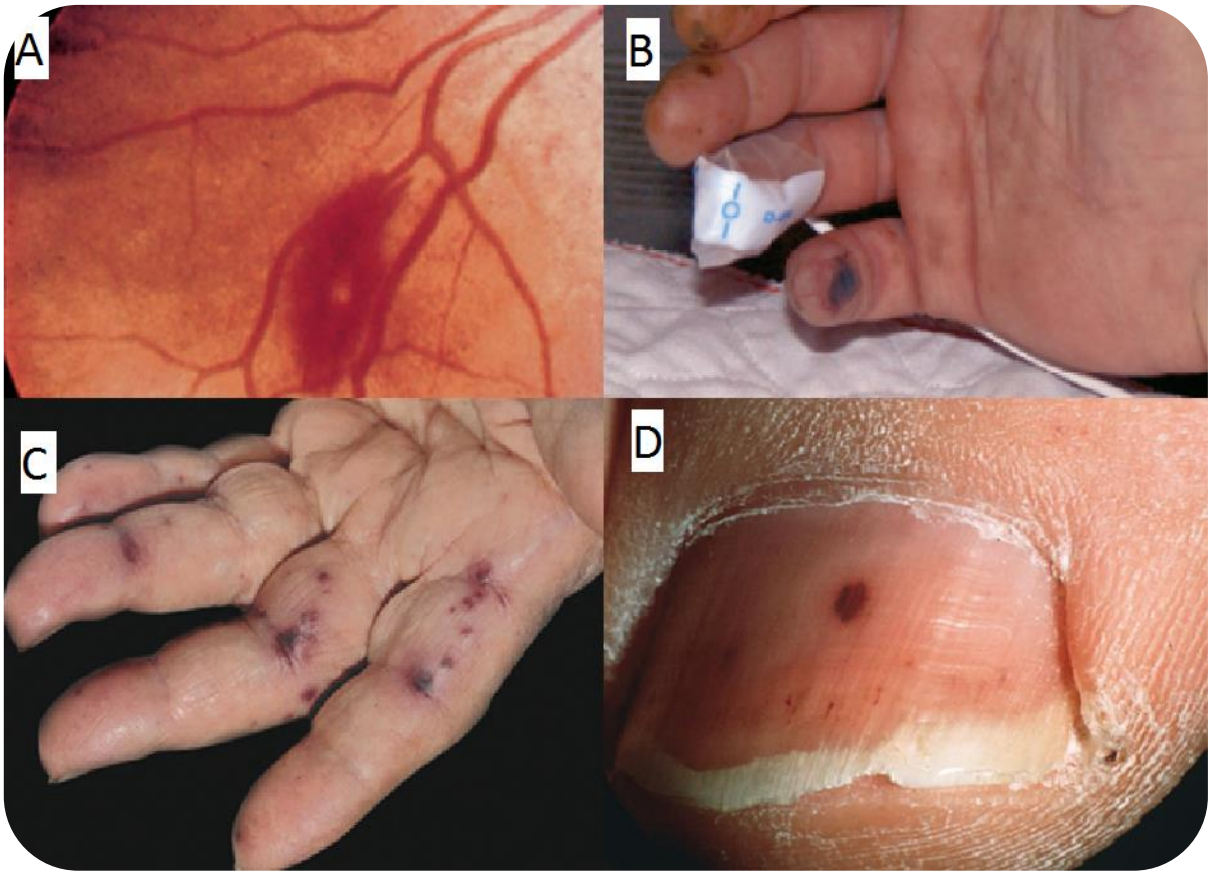

Figure 1 Peripheral signs of infective endocarditis. (A) Roth's spots via ophthalmoscope, (B) Osler's node, (C) Janeway lesion, (D) Splinter haemorrhage.

Dental consideration for prevention of infective endocarditis:

According to the national institute of clinical excellence, patients with following conditions are considered at high risk of developing infective endocarditis (NICE, 2008):

1. Previous episode of infective endocarditis.
2. Acquired valvular heart disease with stenosis or regurgitation.
3. Structural congenital heart disease including surgically corrected or palliated structural conditions, but excluding:
    a. Isolated atrial septal defect
    b. Fully repaired ventricular septal defect
    c. Fully repaired patent ductus arteriosus
    d. Closure devices that are judged to be endothelialised.
4. Valve replacement

Those patients require antibiotic prophylaxis prior to oral surgical procedures and any dental procedures that include manipulation of the gingival tissue or periapical area of dentition, as well as any procedure that cause perforation of the oral mucosa (e.g. Biopsy). This does not include anaesthetic blocks through non-infected tissue or impression taking (Wilson *et.al.*, 2008).

Antibiotic regimes for prophylaxis of bacterial endocarditis recommended by the American heart association are summarized in Table.1 (Wilson *et.al.*, 2008).

Table 1 Antibiotic regimes for prophylaxis of bacterial endocarditis (Wilson *et.al*., 2008)

Situation	Medication	Dosage for Adult (Single dosage 30-60 minutes Prior to procedure)
Oral medication intake	Amoxicillin	2 G
Unable to take oral medication	Ceftriaxone	1 G IM or IV
Allergic to Penicillin and take oral medication	Azithromycin	500 mg
	Clindamycin	600 mg
Allergic to Penicillin and unable to take oral medication	Clindamycin	600 mg IM or IV

It's now established that infective endocarditis can occur from frequent exposure to bacteraemia associated with daily activities more likely than bacteraemia associated with dental procedure. Bacteraemia associated with daily activities have cumulative effect that can precipitate an episode of infective endocarditis. Daily activities can include tooth brushing, flossing, use of toothpicks and even chewing food. Since it's unpractical to prescribe antibiotics for this bacteraemia, therefore it's the healthcare responsibility to emphasize the importance of maintaining good oral hygiene to decrease the frequency of bacteraemia from routine daily activities (Wilson *et.al.*, 2008).

Rheumatic fever and rheumatic heart disease

Rheumatic fever is an autoimmune condition that follows an upper respiratory tract infection with β- haemolytic streptococcal infection and it may progress to involve the heart, causing chronic rheumatic carditis with cardiac valve damage. Cerebral, pulmonary and cutaneous involvement can also occur (Scully, 2014).

Chronic rheumatic carditis occurs due to immune mediated cross reaction with streptococcal antigen which causes tissue damage. The immune-mediated tissue damage may progress after many years to cause fibrosis and significant distortion of the heart valve (i.e. Rheumatic heart disease) (Little *et.al.*, 2012).

Clinical manifestations of rheumatic fever and rheumatic heart disease (Scully, 2014)

1. Sore throat followed by pyrexia.
2. Migratory arthralgia (pain in joints moving from one site to another).
3. Cerebral involvement: manifested by involuntary movement (Sydenham chorea).
4. Cutaneous involvement: this includes characteristic rash (Erythema marginatum) and subcutaneous nodules (usually around the elbows).
5. Cardiac involvement: Including subendocardial inflammation of the mitral and aortic valves, that leads to scaring, fibrotic stiffing and distortion of the valves. Mitral valve stenosis and atrial fibrillation are common sequelae of cardiac involvement. Heart failure can develop after many years.

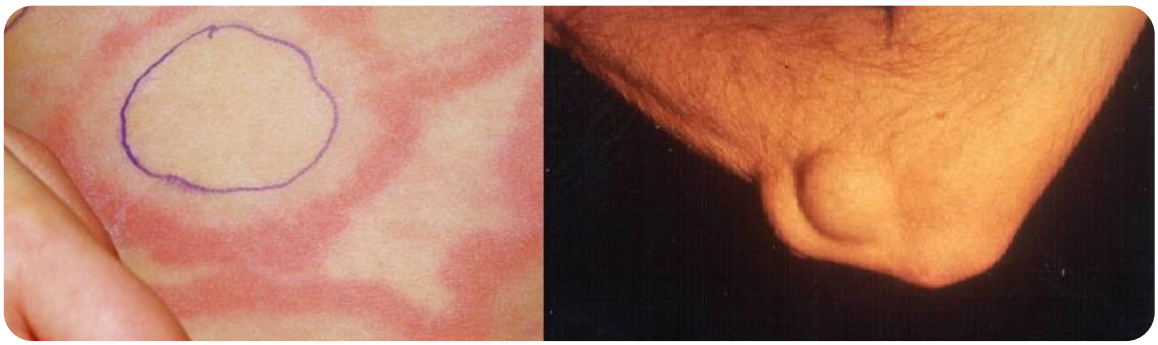

Figure 2 Cutaneous involvement in rheumatic fever. (Left) Erythema marginatum, (Right) subcutaneous nodule.

Dental considerations for rheumatic fever and rheumatic heart disease patients:

There are some important points that the health practitioner should focus and identify in order to provide dental care for such patients. Rheumatic heart disease patients may present with mitral valve stenosis and this might raise the risk of infective endocarditis. According to NICE guidelines this require prophylactic antibiotic prior to any invasive dental procedure (NICE, 2008). Contrary, the American heart association suggested that rheumatic heart disease patients are no longer require any antibiotic prophylaxis, based on the current available evidence (Wilson *et.al.*, 2008).

Another cardiac manifestation that those patients might present with is atrial fibrillation. Usually those patients are on anticoagulant medication (e.g. Warfarin) to prevent the development of thromboembolic event, therefore require careful management as discussed earlier (Scully, 2014).

Congenital heart disease

Congenital heart disease is considered one of the most common developmental anomalies. Previously, many of those patient tend to die early in life, while now they do survive. This is mainly due to advances in their surgical and non-surgical management.

Congenital heart disease can be classified into two major types: Cyanotic and Acyanotic. The latter can be further divided into: with left-to-right shunt and with no shunt (Table.2) (Scully, 2014).

Table 2 Types of congenital heart disease (Scully, 2014)

Cyanotic	Acyanotic	
	With no shunt	With left-to-right
Eisenmenger syndrome	Aortic Stenosis	Atrial septal defect
Tetralogy of fallot	Bicuspid Aortic Valve	Patent ductus arteriosus
Pulmonary atresia	Coarctation of the aorta	Ventricular septal defect
Pulmonary valve stenosis	Dextrocardia	
Total anomalous venous drainage	Mitral valve prolapse	
Transportation of great vessels		
Tricuspid atresia		

Clinical manifestation of congenital heart disease:

The signs and symptoms vary greatly between different types and subtypes of congenital heart disease. In general, the manifestations of cyanotic heart disease are usually more severe than acyanotic heart disease and can include polycythaemia, haemorrhagic tendency, thrombosis, finger- and toe-clubbing(Fig.3) (Appendix I) (Scully, 2014).

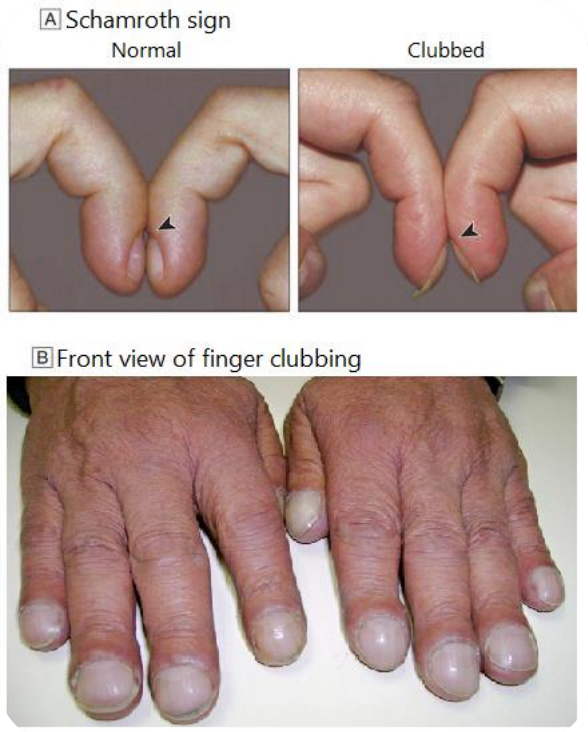

Figure 3 (A) Schamroth sign, (B) Finger-clubbing

Oral manifestation of Cyanotic congenital heart disease (Hallett *et.al.*, 1992) (Scully, 2014):

1. Delayed eruption of both dentitions.
2. Enamel hypoplasia.
3. Greater caries and periodontal disease risk, probably due to poor oral hygiene.
4. After open heart surgery, there is possible appearance of multiple white, non-ulcerated mucosal lesion of unknown aetiology.

Dental consideration for patients with congenital heart disease:

Consultation with patient physician is required to establish the current status of the patient (Ayala and Aguayo, 2016). In addition, any current medication taken by the patient should be reviewed by the health care provider during the first appointment. Appointment is best scheduled between late morning and early afternoon with stress reduction protocol (Scully, 2014).

Since those patients suffer from enamel hypoplasia and greater risk of caries, preventive therapy (e.g. dietary advice, fluoride application) should be provided to all patients. Extraction should be carefully planned, as there is risk of bleeding due to anticoagulant therapy (for patient with thrombotic risk) or due to haemorrhagic tendency (FitzGerald *et.al.*, 2010).

Local anasthesia with adrenaline can be used in limited dosage and by using an aspirating syringe, gingival retraction cord with adrenaline should be avoided (Scully, 2014).

Finally, those patients have the risk for development of infective endocarditis and antibiotic prophylaxis is required for the high risk group as discussed earlier according to the recommendation of the national institute of clinical excellence (NICE, 2008)

Appendix I

Table 5.2 *Main features of congenital heart disease (CHD)*

CHD	Main pathology/location	Main features
Aortic stenosis	Narrowing of the aortic valve	Angina, dyspnoea and syncope. Balloon valvuloplasty or surgery may be indicated
Atrial septal defect (ASD)	Usually near foramen ovale and termed a secundum defect. Associated in 10–20% with mitral valve prolapse	Initially acyanotic, with survival into middle age in most cases, and therefore is the most common CHD presenting in adults. In the absence of surgical correction, right ventricular failure eventually develops. Usually repaired by primary closure or by pericardial or Dacron patch
Bicuspid aortic valve	Valve is bicuspid instead of tricuspid. Often associated with other left-sided lesions (e.g. coarctation of the aorta or interrupted aortic arch)	Usually asymptomatic, even in athletes, but there is a high risk of infective endocarditis
Coarctation of the aorta	In the aorta beyond the origin of the subclavian arteries	Normal blood supply to the head, neck and upper body but restricted to the lower body. Surgery is indicated
Dextrocardia	Right-sided heart	Usually asymptomatic but may be part of situs inversus (all organs transposed) with bronchiectasis and sinusitis (Kartagener syndrome)
Ebstein anomaly	Congenital abnormality of the tricuspid valve, usually associated with ASD	Ebstein anomaly is mild in most and surgery is needed only if the tricuspid valve leaks severely enough to result in heart failure or cyanosis
Eisenmenger syndrome or reaction	The process in which a left-to-right shunt in the heart causes increased flow through the pulmonary vasculature (and pulmonary hypertension) which, in turn, causes increased pressures in the right heart and reversal into a right-to-left shunt	Ventricular or atrial septal defects, patent ductus arteriosus and more complex types of acyanotic heart disease can underlie this. Initially there is pulmonary hypertension, polycythaemia and a hyperviscosity syndrome with haemorrhagic and thrombotic tendencies. Later there is right ventricular hypertrophy and cyanosis. Anticoagulants and pulmonary vasodilators (e.g. bosentan) may be indicated
Fallot tetralogy	Ventricular septal defect, pulmonary stenosis, right ventricular hypertrophy and an aorta that overrides both ventricles. Fluconazole use in pregnancy may predispose	Cyanosis progressive from birth. Chronic hypoxia causes decreased neurological function. Episodes of acute hypoxia from infundibular spasm are life-threatening. Polycythaemia causes hypercoagulability and thrombosis. Right-to-left shunting is associated with a higher incidence of systemic infection such as a brain abscess. Surgery is indicated
Mitral valve prolapse (floppy mitral valve; Barlow syndrome)	The most common CHD, affecting 5–10% of the population. Seen mainly in women. Strong hereditary tendency. Seen especially in Marfan, Ehlers–Danlos and Down syndromes. May be associated with polycystic kidney disease and panic disorder	May cause no symptoms but, if there is mitral regurgitation, some patients develop pain, irregular or racing pulse, or fatigue and heart failure
Patent ductus arteriosus (PDA)	A persistent opening (normally closed by the third month of life) between aorta and pulmonary artery, common in prematurity and maternal rubella	Shunt is left to right, initially acyanotic, and a typical complication is right ventricular failure. Closure can be promoted in early infancy by giving intravenous indometacin, a prostaglandin inhibitor
Patent foramen ovale	Communication between atria	Often symptomless
Pulmonary atresia	No pulmonary valve exists, so blood cannot flow from the right ventricle into the pulmonary artery and to the lungs. The right ventricle is not well developed. The tricuspid valve is often poorly developed. An ASD allows blood to exit the right atrium, so the baby is cyanotic. The only source of lung blood flow is the PDA	Early treatment often includes using a drug to keep the PDA from closing, and surgery to create a shunt between the aorta and the pulmonary artery
Pulmonary stenosis	Narrowing of the pulmonary valve	Symptoms are breathlessness and right ventricular failure. Balloon valvuloplasty or surgery may be indicated
Total anomalous pulmonary venous return (TAPVR)	Blood returns from the lungs to the right rather than left atrium	Survivors also have ASD or patent foramen ovale
Transposition of the great vessels	Reversal of pulmonary artery and aorta origins	Cyanosis and breathlessness from birth, with early congestive cardiac failure and death in infancy unless there are associated defects providing sufficient collateral circulation (such as a patent interventricular septum or PDA)
Tricuspid atresia	Absence of the tricuspid valve means no blood can flow from the right atrium to the right ventricle. Thus the right ventricle is small. Survival depends on there being an ASD and usually a ventricular septal defect	A surgical shunting procedure is often needed to increase the lung blood flow and reduce cyanosis. Some children may need pulmonary artery banding to *reduce* blood flow to the lungs. Others may need a more functional repair (Fontan procedure)
Ventricular septal defect (VSD)	One of the most common CHDs. Ranges from a pinhole compatible with survival at least into middle age, to a large defect causing death in infancy if untreated. Some 90% of children with VSD have an additional cardiac defect	Initially left-to-right shunt but, with right ventricular hypertrophy, shunt may eventually reverse with late-onset cyanosis. Right ventricular failure may develop. Usually repaired by primary closure or by a pericardial or Dacron patch

References:

AYALA, C. D. L. L. & AGUAYO, L. 2016. *Oral and systemic manifestations, and dental management of a pediatric patient with Tetralogy of Fallot. A case report*.

FITZGERALD, K., FLEMING, P. & FRANKLIN, O. 2010. Dental health and management for children with congenital heart disease. *Prim Dent Care,* 17**,** 21-5.

HALLETT, K. B., RADFORD, D. J. & SEOW, W. K. 1992. Oral health of children with congenital cardiac diseases: a controlled study. *Pediatr Dent,* 14**,** 224-30.

LITTLE, J. W., FALACE, D., MILLER, C. & RHODUS, N. L. 2012. *Dental Management of the Medically Compromised Patient - E-Book*, Elsevier Health Sciences.

SCULLY, C. 2014. *Scully's Medical Problems in Dentistry E-Book*, Elsevier Health Sciences.

The National Institute for Health and Care Excellence-NICE, T. N. I. F. H. A. C. 2008. Prophylaxis against infective endocarditis: antimicrobial prophylaxis against infective endocarditis in adults and children undergoing interventional procedures. *NICE Clinical Guideline*.

URBANO, F. L. 2000. Peripheral Signs of Endocarditis. *Hospital Physician,* 36**,** 41-46.

WILSON, W., TAUBERT, K. A., GEWITZ, M., LOCKHART, P. B., BADDOUR, L. M., LEVISON, M., BOLGER, A., CABELL, C. H., TAKAHASHI, M., BALTIMORE, R. S., NEWBURGER, J. W., STROM, B. L., TANI, L. Y., GERBER, M., BONOW, R. O., PALLASCH, T., SHULMAN, S. T., ROWLEY, A. H., BURNS, J. C., FERRIERI, P., GARDNER, T., GOFF, D. & DURACK, D. T. 2008. Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *J Am Dent Assoc,* 139 Suppl**,** 3s-24s.