

INFECTIVE ENDOCARDITIS IN CHILDREN: RETROSPECTIVE STUDY OF 33 CASES

ENDOCARDITE INFECTIEUSE CHEZ L'ENFANT: UNE ETUDE RETROSPECTIVE DE 33 CAS

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Abstract

Infective endocarditis (IE) in children is a serious pathology, with significant mortality and morbidity. The purpose of this work: to study the clinical, para-clinical and therapeutical profile and the evolution of the IE in children.

Methods: Retrospective study of 33 cases collected between 1999 and 2019 in the pediatric department, the Pediatric Intensive Care Unit and the department of cardiology in Hedi Chaker University Hospital.

Results: The sex ratio was 1.06. The average age was 8 years old and 4 months. An underlying congenital heart disease was found in 17 cases. The most common germs were Staphylococcus and Streptococcus. The most common complications were heart valve insufficiency, heart failure and embolic complications. 8 patients died. The post-operative characters, embolic, neurological complication and heart failure are the predictors of death.

Conclusion: IE affect especially children with cardiac abnormalities. It can also be the way of discovering a heart disease.

Key - words: Children infective endocarditis in children; Rheumatic heart disease; congenital heart disease; Echocardiography.

Résumé

L'endocardite infectieuse (EI) chez l'enfant est une pathologie lourde, grave, de mortalité et de morbidité importantes.

But du travail : Etudier le profil clinique, para-clinique, thérapeutique et évolutif de l'EI.

Méthodes : Etude rétrospective de 33 cas d'EI colligés entre les années 1999 et 2019 au sein du service de pédiatrie, pédiatrie urgences et réanimation pédiatriques et cardiologie au CHU Hedi Chaker.

Résultats : Le sex-ratio était égal à 1.06. L'âge moyen des patients était de 8 ans et 4 mois. Une cardiopathie congénitale sous-jacente a été retrouvée dans 17 cas. Les germes les plus fréquents étaient le *Staphylocoque* et le *Streptocoque*. Les complications les plus fréquentes étaient l'insuffisance valvulaire, l'insuffisance cardiaque, et les complications emboliques. 8 patients sont décédés. L'étude analytique a conclu que le caractère postopératoire, les complications emboliques la défaillance cardiaque et les complications neurologiques sont des facteurs prédictifs de mortalité.

Mots-clés: Endocardite infectieuse ; Enfant ; Cardiopathie acquise ; Cardiopathie congénitale ; Echocardiographie.

ملخص

التهاب داخل القلب الخمجي عند الأطفال هو حالة خطيرة وخطيرة ذات وفيات اعتلالات كبيرة. الهدف من العمل: دراسة المظهر السريري، شبه السريري والعلاجي والتطوري لهذا المرض. الطريقة: دراسة بأثر رجعي لـ 33 حالة من التي تم جمعها بين أعوام 1999 و 2019 في طب الأطفال، طب الطوارئ والإنعاش لدى الأطفال و طب أمراض القلب بالمستشفى الجامعي الهادي شاكر بصفاقس. النتائج: كانت نسبة الجنس 1.06. كان متوسط عمر المرضى 8 سنوات و 4 أشهر. تم العثور على مرض القلب الخلقى الكامنة في 17 حالة. أكثر الجراثيم شيوعاً هي المكورات العنقودية والعقدية. كانت المضاعفات الأكثر شيوعاً هي فشل الصمام وفشل القلب والمضاعفات الصمة. حصلت وفاة 8 مرضى. وخلصت الدراسة التحليلية إلى أن المظهر بعد العملية الجراحية والمضاعفات الصمة وفشل القلب والمضاعفات العصبية هي من منبئات الوفاة.

الكلمات المفتاحية: التهاب داخل القلب الخمجي ; الطفل ; أمراض القلب المكتسبة ; أمراض القلب الخلقية ; التصوير بالصدى للقلب.

INTRODUCTION

The epidemiological profile of infective endocarditis (IE) in children is quite different from that of adult [1]. It is a pathology much rarer, which grafts on a different ground. There is an emergence of IE on congenital heart disease whether operated or not, postoperative IE and especially IE on a structurally normal heart. The germs responsible for the endocarditis of the child have not changed in favor of time [2]. First and foremost, *streptococci*, especially *viridans*, and *staphylococci*, especially *aureus*. Thanks to advances in bacteriological diagnosis, the identification of the causal germ is possible in the vast majority of cases. It can be made in the blood by blood cultures, at the level of primary or secondary foci. It can also be found at the level of the portal of entry or by culture of valve or prosthetic material taken during an intervention. IE in children [3], as well as in adults, is a serious pathology potentially lethal; despite the diagnostic progress (related to the contribution of echocardiography) and despite the therapeutic progress (related to the introduction of new effective antibiotics) and the widening of surgical indications which sometimes worn urgently as a real life saving gesture.

The objective of this study through 33 cases is to determine the clinical, para-clinical and therapeutic profile and the evolution of this affection (IE) in children, highlight the diagnostic difficulties of the IE in children, determine the predictors of intra-hospital mortality and compare our results with data from the literature.

METHODS

This work is a retrospective study of patients under the age of 16 years, who had one or more episodes of IE, diagnosed with reference to "modified Duke criteria" and hospitalized in the pediatric department, pediatric emergency and resuscitation department and the cardiology department, in HediChaker University Hospital, Sfax, Tunisia, for a period of 21 years: from 1st of January 1999 to 31st of December 2019.

For each patient, we studied the various anamnestic, clinical, paraclinical, therapeutic and evolutionary parameters. At the anamnesis we looked for demographic parameters, pathological antecedents and clinical history. In the clinical study we have mainly tried to recognize the temperature, the data of cardiac auscultation, the presence or absence of signs of heart failure,

the presence or absence of splenomegaly, the data of the cutaneous and osteoarticular examination and the various signs evoking a complication or a possible portal of entry. The paraclinical investigations studied were mainly the inflammatory assessment, the bacteriological examinations, the serology of the intracellular bacteria and the stigmas of an immunological disorder (presence of circulating immune complexes or of rheumatoid factor). We also studied the radiological investigations carried out in order to detect any complication. We defined a positive C reactive protein by a value greater than 6 mg/l, an accelerated sedimentation rate by a value greater than 20mm/hour and a positive procalcitonine by a value greater than 0.5 µg/ml. Echocardiography was a key examination. The goal was to search for signs of diagnosis, underlying heart disease or complications. We have studied cardiac architecture, the left ventricle and pulmonary arterial pressures. We defined a pulmonary arterial hypertension by pulmonary pressures greater than 40 mmHG and an electrical hypertrophy of the left ventricle by a Sokolow index greater than 40mm. We classified postoperative IE into early and late according to the time limits between surgery and diagnosis of IE (less than or more than 12 months, respectively). For the therapeutic means we studied in particular the antibiotic therapy and the cardiac surgery: the different combinations of antibiotics, the time of their introduction, the change, the type of surgery, the time of realization and the indications. The evolution in the short, medium and long term was studied from hospital records, followed consultation and phone calls. The descriptive study and the analytical study were carried out thanks to SPSS software. The chi-square test was used for the comparison of qualitative variables. The confidence interval was 95% and the result was considered significant for P <0.05.

RESULTS

We collected thirty-three children with IE. The number of IE cases varied from 1 to 5 per year with an average of 1.8 cases / year; that is 0.16 cases / 1000 admissions/year.

We noted a slight female predominance, with a sex ratio (female / male) equals to 1.06 (17 girls and 16 boys). The average age of our patients was 8 years and 4 months, with extremes ranging from 8 months to 16 years. Four patients (12.12% of cases) aged less than 2 years.

The presence or absence of underlying heart disease was specified in all cases; there were 10 children (30.3%) which had an apparently healthy heart and a known heart disease was found in 23 cases (69.7%). 17 of these, had congenital heart disease (51.5%) and 6 children had acquired rheumatic heart disease (18.2%). Two rheumatic heart diseases were discovered during the diagnosis of IE.

Septal defect was the most common congenital heart disease in our series. It was present in 8 children, who represent 24.2% of all children and 47% of patients with congenital heart disease in our series. Among the eight patients with rheumatic heart disease, 5 had mitral insufficiency and the 3 had mitral and aortic insufficiency.

Details of congenital heart diseases are highlighted in **Table 1**.

The average time between onset of symptoms and the consultation, in our series, was 27 days. For 7 patients, infectious endocarditis was reported postoperatively with a meantime to onset of symptoms of 24.5 days. Thirty patients (90.9%) had functional signs. Fever was almost constant (88.5% of cases) with an average duration of 19.3 days. Clinical features at time of diagnosis are seen in **Table 2** and **Table 3**.

The portal of entry was found or suspected in 19 children (57.5%); it was dental in 24.2% of cases, dermal in 6.1% of cases, ENT in 9.3% of cases and postoperative in 18.2% of cases.

All our patients had a transthoracic echocardiography, with an average time between admission and realization of 3.8 days. The most common valvular lesions in our series were represented by vegetations: 32 cases (97%). These vegetations were mobile in 21 cases (65.6% of cases). Their size was between 10 and 15 mm in 11 children and more than 15 mm in 9 children. They had affected the mitral valve in 11 cases (33.3%), the tricuspid valve in 10 cases (30.3%), the aortic valve in 5 cases (15.1%), the aortic and mitral valve in 3 cases (9%) and the pulmonary valve in 3 cases (9%). The different valvular lesions are shown in **Table 4**.

We reported Leukocytosis in 21 patients (63.6% of cases) and leucopenia in 2 patients (6% of cases). C-reactive protein (CRP) was performed in 26 patients (78.7%). It was positive in 19 children (59.4% of cases). Sedimentation Rate was performed in 27 cases (81.1%) and was accelerated in 25 patients (78.1%).

Despite its recent use, the procalcitonin was only done for 4 patients of our series and it was positive in these 4 children.

Blood cultures were performed for all patients in our series, with an average number of 5 (the extremes ranged from one to 18). The average time to perform blood cultures was 2 days after admission (with extremes of 0 and 24). At least one or more blood cultures were positive in 13 cases (39.4%). The ratio of positive blood cultures was 1 for 3 patients, 0.6 for a patient, 0.5 for 6 patients, 0.37 for a patient, 0.33 for a patient and 0.25 for a patient **Table 5**.

For one patient only, the endocarditis was on prosthetic valve. Seven cases of early postoperative endocarditis were noted.

Seven patients in our series were operated. The indication was hemodynamic for 1 patient, septic for 1 patient and embolic for 5 patients. The average time between admission and cardiac surgery was 7.1 days. Five patients underwent conservative surgical treatment and 2 patients had valve replacement.

One or more complications were noted in 19 cases (59.4% of cases): 10 patients presented hemodynamic disorders, 9 patients presented heart valve insufficiency, 5 patients presented neurological complications (hemorrhagic stroke, mycotic aneurysm leads to intraventricular hemorrhage complication, two ischemic stroke and purulent meningitis) and 13 patients presented an embolic complication (Emboli localization was pulmonary in 6 cases, cerebral in 3 cases, meningeal in 1 case, splenic and renal in 1 case, splenic in 1 case and renal in 1 case). These embolic complications were asymptomatic in 9 cases and they were retained by 2 abdominal ultrasounds, an abdominal CT, 2 cerebral CT, 3 pulmonary scintigraphies, 3 chest radiographies and a lumbar puncture. Complications and outcomes of endocarditis admissions are summarized in **Table 6**.

The average time to obtain apyrexia was 7.3 days in our series. The average hospital stay was 39.6 days. The evolution was fatal in 8 cases of our series (25.8% of patients). The average time between hospitalization and the occurrence of death was 20 days, with extremes ranging from 3 to 56 days. The death was postoperative in 3 cases (two patients having had a surgical treatment of the IE and a patient having had a surgery for double outlet right ventricle).

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The time between surgery and the occurrence of death was 7 days for one child, 20 days for the second and 44 days for the third child. The cause of death was heart failure for 4 patients, septic shock for two patients, nosocomial pneumopathy for one patient and mycotic aneurysm rupture in the other case.

Two patients in our series (6.7% of cases) had recurrent infective endocarditis. The recidivism period was 80 days for one patient and 180 days for the other.

We have tried to study several factors that can be predictive of intra-hospital mortality; namely age,

sex, presence of heart disease or heart prosthesis underlying diagnosis time, postoperative character, the presence of mobile vegetation or annular abscess, the need for surgery, the occurrence of a hemodynamic and / or neurological and / or embolic complication, the change of antibiotics and the isolation of a staphylococcus. According to the analytical study carried out, cardiac surgery and the presence of an embolic and / or hemodynamic and / or neurological complication constitute a positive predictive factor of mortality. **Table 7** shows the different predictive factors of intra-hospital mortality.

Table 1: Congenital heart diseases

	Number	percentage
<u>Non operated congenital cyanogenic heart disease</u>	0	0
	8	47
<u>Left to Wright shunt</u>		
Septal defect	6	35.29
Septal defect+ aortic dysplasia+ aortic stenosis	1	5.88
Arterial duct	1	5.88
<u>Heart valve regurgitation</u>	1	5.88
Mitral valve regurgitation	1	5.88
<u>Operated congenital heart diseases</u>	8	47
<u>Operated congenital heart diseases without residual lesions</u>	3	17.64
Double outlet right ventricle	1	5.88
Septal defect	1	5.88
Arterioventricular canal	1	5.88
<u>Operated congenital heart diseases with residual lesions</u>	5	29.41
Laubrypezzi syndrome	1	5.88
Tetralogy of fallot	1	5.88
Pulmonary stenosis	1	5.88
Aortic disease	1	5.88
Transposition of great vessels+ narrowed pulmonary valve	1	5.88

Table 2: Frequency of different functional signs

Symptom	Percentage
Fever	88.5%
Dyspnea	34.6%
Chest pain	19.2%
Flu syndrome	28%
Arthralgia	26.9%
General deterioration	30%
Cutaneoussigns	3%
Headaches and/or convulsion and/or paralysis and/or coma	7.7%

Table 3: Frequency of different physical signs.

Physical signs	Percentage
Fever	75%
Heart murmur	81.8%
Gallopings noise	9.4% %
Auscultatory arrhythmia	3.1%
Signs of right heart failure	12.3%
Hepatomegaly	25%
Splenomegaly	14.8%
Ascites	6.3%
Edema of the lower limbs	9.3%
Tachycardia	76.7%
Meningeal syndrome	3.1%
false paronychia of Osler	3.1%

Table 4 : Abnormalities observed by echocardiography

	Percentage
Vegetation	97%
Valvular perforation	12.1%
Rupture of the valvular cords	9.1%
Valvularabscess	3%
Annularabscess	9.1%
Leftventricularejection fraction between 30% et 50%.	12.1%
Pulmonaryarterial hypertension	37.5%
Pericardial effusion	9.1%

Table 5: Patients with positive blood cultures

Patient number	Number of blood cultures done	Number of blood cultures positives	Ratio	The isolated germ
1	2	2	1	<i>Acinetobacter</i>
2	12	12	1	<i>Staph aureus</i>
3	3	3	1	<i>Non groupable streptococcus</i>
4	5	3	0.6	<i>Staphépidérmidis</i>
5	6	3	0.5	<i>Streptocoque sanguis</i>
6	6	3	0.5	<i>Non groupable streptococcus</i>
7	8	4	0.5	<i>Staph aureus</i>
8	6	3	0.5	<i>Staph aureus</i>
9	2	1	0.5	<i>Bartonellahenselae</i>
10	4	2	0.5	<i>Staphépidérmidis</i>
11	8	3	0.37	<i>Streptocoque oralis</i>
12	9	3	0.33	<i>Staph aureus</i>
13	4	1	0.25	<i>Kleibsiellepneumoniae</i>

Table 6 : complications of IE

	Number	Percentage
Hemodynamic disorders	10	30.3%
Heart valve insufficiency	9	27.2%
Embolic complications	13	39.4%
Ischemic stroke	2	6%
Hemorrhagic stroke	1	3%
Mycotic aneurysm complicated with intra ventricular hemorrhage	1	3%
Purulent meningitis	1	3%
Recidivism	2	6%
Death	8	24.2%

Table 7: Predictive factors of intra-hospital mortality

Parameter	Survivor patients	Deceased patients	P=
Age	9 ans+5 months	7 ans+11 months	0.36
Sex : Girls/Boys	15/10	2/6	0.13
Underlyingcardiacdisease	18	7	0.95
Average time for diagnostic	3.27 days	5.57 days	0.78
Postoperative IE	4	2	0.02
IE on cardiacprosthesis	1	0	0.55
Mobile vegetation	18	3	0.36
Annularlyabscess	2	1	0.75
SurgicalTreatment	5	2	0.64
Hemodynamic complication	3	7	0.00
Neurologic complication	1	4	0.00
Embolic complication	7	6	0.03
Change of antibiotic	13	3	0.30
Staphylococcal IE	6	1	0.31

DISCUSSION

Epidemiology:

We describe the epidemiological, clinical, Para clinical, therapeutic and evolutionary findings in a series of 33 children with IE. We have estimated that the incidence is to be 0.16 cases per 1000 admissions per year over the period of the study. Thus IE in children appears to be a rare pathology. The average age of patients in the present study was 08 years and 04 months, with 4 patients (12.12% of cases) having an age less than 2 years. Studies that have tried to estimate the incidence of this pathology are rare[4,5,6]. Over the past decades, there has been an increase of IE in children and the average age of people with this disease has decreased. This is can be linked to many factors: the surgery of patients with heart disease at an early age, the increase in the life expectancy of patients with complex congenital heart disease, the more frequent use of central catheters (responsible of IE in a structurally normal heart and in young or immune compromised children) and in particular the improvement of diagnostic and therapeutic techniques [4,5,6].

The underlying heart disease :

We noted that almost a quarter of the patients had a structurally normal heart and that the half had underlying congenital heart disease. This situation is closer to that in the developed countries than that in the third world. In developed countries, there is a regression of rheumatic heart disease in favor of congenital heart disease and structurally normal heart. Most developing countries are, currently, in progressive epidemiological transition. This transition is characterized by the emergence of postoperative endocarditis, IE on structurally normal heart and on congenital heart disease[6,9,10] ,but the share of rheumatic heart disease is still significant till the present day.

The heart diseases "corrected", not operated or having had a palliation, are affected by the bacterial transplant[11] .Surgical repair is supposed to reduce or even cancel the risk. This is the case unless no residual lesion persists[12]. The repair of congenital heart diseases, especially that are complex, may involve the establishment of prosthetic valves or pacemaker, which are with a high-risk of infections. It may also leave valve lesions or other shunts at risk, although lower, but

non-zero. Sometimes, the repair removes any residual lesion and cancels the risk of infectious endocarditis (for example, patch closure of isolated Ventricular septal defect). But it is important to know that corrective surgery does not systematically eliminate the risk of IE[12]. Not operated ventricular septal defect should not be underestimated. It is classified as moderate-risk heart disease but its prevalence is high. It is the most common congenital heart disease of IE followed by patent arterial ductus [13].

The transplant is sometimes done on a structurally normal heart, especially in the acute forms of the infant in a context of prolonged medical reanimation[11].

Clinical study:

Fever is an almost constant sign [4,10,11]. It is present in 98% of cases (88.5% of children in our study). It can constitute the sign of appeal and assume all aspects (moderate and prolonged or high associated with chills). Cardiac auscultation is suggestive only when it asserts the appearance of a cardiac murmur or shows a change in the intensity and / or the tone of a previously known cardiac murmur. The modifications of the murmur are not frequent, but have a great diagnostic interest. They can constitute the first alarm sign, but it is frequent that they appear secondarily, sometimes after sterilization of the lesions [16]. Extra-cardiac manifestations of IE in children are less common than in adults [17].

IE of the left heart must be suspected in presence of clinical signs of left ventricular dysfunction, in a septic context, with an abnormal cardiac figure on the chest X-ray.

Complementary investigations:

With blood culture, echocardiography is the key investigation that allows the morphological confirmation of infection. It helps in therapeutic management in patients suspected of IE. It must be remembered that a normal initial echocardiography does not eliminate the diagnosis of IE. It is desirable to repeat the examination a few days later, if the diagnostic doubt persists[18]. It must be remembered also that the diagnosis can be not definite in complex heart diseases with multiple valvular abnormalities.

In the present study, blood cultures were negative in 20 cases (60.6%). This high percentage can be explicated by anterior antibiotic therapy (5 cases), the defective methods of realization and defective culture. In developing countries, the proportion of

IE with negative blood cultures remains high. Because of the excessive prescription of antibiotics in the pediatric population and the defective means of diagnosis. Because also, of the infection with a germ difficult to cultivate (intracellular bacteria or belonging to the HACEK group) or a fungal infection, of which the sensitivity of blood cultures is only 54% [19].

Blood cultures should be performed before the initiation of antibiotic therapy in any febrile child without an obvious infectious site with cardiac murmur, congenital heart disease, or a history of IE[17]. Antibiotics prescribed unexpectedly and blindly may delay the diagnosis and underestimate the causative germ. In our study, the realization of blood cultures was late for the majority of the patients. The causes were especially the non availability of the bottles of blood culture and non evocative signs.

According to literature data, gram-positive cocci are the most isolated organisms in patients with IE and our results were compatible (10 of the 13 positive cultures have isolated a gram-positive cocci). Among the other germs, it should be noted that the frequency of gram-negative bacilli of the HACEK group has been increasing for about 20 years, like fungal endocarditis.

The portal of entry:

Infectious portal of entry are most often suspected than actually identified[20]. In any case, it is the mucosal breakthrough that is responsible for the bacteraemia. Thus, all localized infections, regardless of site, including streptococcus or staphylococcus, are a potential entry points for IE in children with high risk[21]. It remains unknown in the third of cases[1]. In our series the portal of entry was unknown in 42.5% of cases, dental in 24.2% of cases, dermal in 6.1% of cases, ENT in 9.3% of cases and postoperative in 18.2% of cases.

Evolution:

The immediate evolution of IE may include many complications. These complications are frequent, sometimes revealing and make the severity of IE.

In our series 7 of the 10 children who presented hemodynamic disorders are dead. Valve leaks and heart failure represent the most common complications of IE and the serious causes of death [17,19]. Its pejorative warning significance is emphasized in all recent studies [17,22,23]. Conduction disorders as well as ventricular and supra-ventricular arrhythmias also have a pejorative significance. They indicate an extension

of the infection and the formation of abscesses that damage the atrio-ventricular and intra-ventricular conduction pathways[22].

In the present study 13 patients (39%) presented embolic complications, that occur, according to the literature, in 22% to 50% of IE cases[19,20,21]. Emboli often involve major arterial beds, including the lungs, coronary arteries, spleen, intestine and extremities. Up to 65% of embolic events involve the central nervous system and are the most serious in terms of vital and functional prognosis: second cause of death[17].

Two of our patients (6%) presented recidivism. The actual risk of IE recidivism ranges from 2% to 6% (31). There are two main types of recurrence: relapse and reinfection. Although not systematically differentiated in the literature, the term "relapse" refers to a repetition of episode of IE caused by the same microorganism, while "reinfection" describes an infection caused by another microorganism. There is no rule for the time between episodes, but usually it is shorter for relapse than for reinfection. In general, a recurrence caused by the same species within 6 months of the initial infection defined the relapse; whereas later events suggest reinfection[27].

Eight of our patients died (25.8%). The death was postoperative in 3 cases (37.5% of deceased patients). The cause of death was heart failure for 4 patients, sepsis for 2 patients, nosocomial pneumonia for 1 patient and mycotic aneurysm rupture for the other case.

From our analytical study, we retained that the postoperative character and the occurrence of embolic and / or hemodynamic and / or neurological complications are predictive factors of mortality during an IE. The most common prognostic factors are the cardiac conditions of comorbidity, the type of microorganism involved (staphylococcus aureus and fungal infections) [14], the localization (left heart), the increase in size of vegetations, acute character of onset of endocarditis and complications (heart failure, renal failure, neurological involvement or rhythmic and conductive disturbances). In the most recent studies in developed countries, the mortality has decreased: 4-7% in recent Americans studies[22,23] and 6% in a recent Italian register[30].

Treatment:

Therapeutic management during an IE must have the objectives of eradicating the microorganism present in the blood and the vegetations (in order to avoid relapses). It must also

treat the extensive and destructive cardiac lesions as well as the extra cardiac complications (to reduce the morbidity and mortality). In this context, antibiotic therapy alone is not enough. Other treatments (especially surgery) are often necessary. Antibiotic therapy is well codified (molecules, duration and monitoring) according to the isolated or suspect causal germ. The occurrence of clinical events may require a review of antibiotic therapy or complementary surgical attitude. Surgical indications are codified as well. The current trend is towards earlier surgery that favors valve repair[31,32]. The 3 main complications of IE are also the 3 main surgical indications retained by the new ESC 2015 recommendations: heart failure, uncontrolled infection and systemic embolism[31].

It should be remembered that the persistence or re-ascension of fever does not always mean the inefficacy of antibiotic therapy. This febrile state may be secondary to certain complications of IE, hypersensitivity to antibiotics; other complications related to treatment (catheter infection for example) or inter current pathologies.

The 2015 European Recommendations seek to restrict the indications for antibiotic prophylaxis for the most patients that are at-risk, in the invasive procedures that are most at risk. In addition to prophylaxis, they emphasize on the importance of oral hygiene, the information about the patient at risk of endocarditis and their knowledge of the symptoms suspected of IE[31].

CONCLUSION

IE in children is much rarer than that of the adult. It can affect children with a structurally normal heart, but especially children with cardiac abnormalities. It can also be the way of discovering a heart disease. Any pediatrician, cardiologist or general practitioner must know the various signs suggestive of an IE. Above all, he must think of it a febrile patient with heart disease, without a clear infectious site and in front of any combination of heart murmur and fever. Despite significant progress in terms of bacteriological diagnosis and surgical management in the acute phase, IE in children still a serious pathology whose mortality still significant. Its management must be multidisciplinary, early and adequate.

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