THESIS FOR DEGREE OF DOCTOR OF PHILOSOPHY

CRITICAL EVALUATION OF THE CARE OF CHILDREN WITH HEART DIASESES IN HAJDÚ-BIHAR COUNTY

GÁBOR MOGYORÓSY, M.D.

DEPARTMENT OF PAEDIATRICS
UNIVERSITY OF DEBRECEN
DEBRECEN,
HUNGARY
2001

1. INTRODUCTION

The perspectives of children born with heart disease have never been so favourable as nowadays. The development in the field of interventional cardiology and heart surgery narrowed the range of incurable heart diseases. The optimal age for the correction of heart diseases shifted to early infancy. Up-to-date care requires high professional knowledge and sophisticated cooperation of different specialities. The relative rarity of cases makes difficult the obtaining of proper skill. The low volume increases further the per-unit costs of the otherwise expensive procedures. The characteristics of paediatric cardiology and heart surgery mentioned above may be an important factor altering effectiveness and efficiency of care.
Inevitable evidences proved that serious errors could occur in the care of children with heart diseases.
Clinical audit is a proper method to evaluate the quality of care in the field of paediatric cardiology. Audit is the process of critically and systematically assessing our own professional activities with a commitment to improving personal performance and, ultimately, the quality and/or cost-effectiveness of patient care. Creating proper criteria and standards is the most critical step of audit process. Criteria have been defined as „systematically developed statements that can be used to assess the appropriateness of health care decisions, services and outcomes". On the other hand, a standard is: „The percentage of events that should comply with the criterion". Implementing new procedures in the field of paediatrics challenge paediatric cardiologists as well. Certain procedures accompanied with significant hemodynamic changes (e.g. haemodialysis) appear as important cardiovascular risk factor. New interventions may lead to new complications being unknown so far. The common characteristic of these factors and complications is that they appear rarely.
*The risk of inappropriate care is much higher in case of rare diseases. T*he evaluation of rare events with statistical or epidemiological methods is limited. In the United States the rare, unexpected complications are defined as "***sentinel events***" and the evaluation of their cause is specially stressed. Sentinel event analysis is based on the assumption that health care organizations can and should take proactive steps to reduce and prevent errors. Because systems are the root of the majority of errors, redesign initiatives aimed at system improvements can be productive. To minimize the possibility of errors is of crucial importance not only because of ethical reasons but in cost reduction too.
The name for the evaluation of rare events is variable (critical incident, sentinel event, significant event) but the methodology is very similar. In this study the *„significant event audit"* term is used according to Pringle et al (Occas Pap R Coll Gen Pract 1995; 70: 1-71).
Objective measures of the quality of care cannot be developed without the knowledge that the outcome how strongly is affected by the happening of a procedure. The practice of evidence-based medicine provides us reliable data on how strong is the relationship between intervention and outcome. The practice of evidence-based medicine is valuable in the analysis of significant events. Structured questioning may carry out a step-by-step analysis of the process leading to the unexpected outcome: How strong is the relationship among the following elements: the patient/problem – intervention/underlying factor – outcome. Systematic literature review may be very important to reveal the root cause of the rare event.
Besides criteria and standards, quality indicators are used for the judgement of quality. Indicators should be used where direct measure of quality is impossible or very expensive. Indicator is a quantitative measure that can be used as a guide to monitor and evaluate the quality of important care and support service activities. An indicator is not a direct measure of quality. Rather, it is a screen or flag that identifies or directs attention to specific performance issues within a health care organization that should be the subject of more intense review.

2. AIMS OF THE STUDY

I. Investigation of the applicability of quality measurement methods (criterion based audit, significant event audit, quality indicators) in the field of paediatric cardiology and paediatric heart surgery.

II. We perform the critical evaluation of care of congenital heart diseases in Hajdú-Bihar County. We use the criterion based clinical audit method. The aim of the investigation is to answer the following questions:

- Are congenital heart diseases diagnosed in time?
- Are the number and quality of invasive procedures (surgery and interventional catheterisation) appropriate?

III. To realise the previous target we perform an epidemiological survey, which has never been performed in Hajdú-Bihar County. The more recent study in Hungary is more than 30 years old. The survey makes it possible to compare our results with international data.

IV. We considered the analysis of two, rare cardiac complications important. The actuality of these complications is due to the development of paediatric subspecialties. Our aim is to develop a method suitable for critical evaluation of rare, unexpected events concerning quality problems.

3. METHODS

In the course of evaluating the care of children with congenital heart diseases the methodology of clinical audit was used.

3.1. Identification of criteria against which to judge performance of paediatric cardiac care

In the course of developing method of identification of criteria that is measurable by already existing databases was an important point. According to the strength of research evidence and impact on outcome criteria were prioritised. Three categories were created: „must do", „should do" and „could do" criteria.

Must do criteria:

- Critical congenital heart diseases must be identified in time.
    - Death must not be the result of unrecognised heart disease in infancy.
    - Heart disease must be identified before the onset of avoidable complications.
- Death must not occur from isolated heart disease in infancy.
- Invasive therapy must be accessible for each child who is in need of it.
- The correction of the congenital heart disease must be performed at optimal age of the child.
- The postoperative mortality must not be higher than the unavoidable risk.

Should do criterion:

- The surgical waiting time should not be longer than one year in non-urgent cases.

Could do criterion:

- All congenital heart diseases should be identified.

3.3.Critical analysis of the care of acquired heart diseases

The acquired heart diseases selected for detailed analysis were the complications of other non-cardiac diseases. All of these selected cardiac diseases were serious. Through systematic literature review the possible technical, organizational and human factors were identified that could play a role in the development of the disease. On identification of possible causes the following aspects were taken into consideration: structure of care, processes, decisions made during the care. Finally the root cause was identified.

3.4. Method of developing quality indicators

The process of care was surveyed by flowcharts in case of newborns with severe congenital heart diseases. The critical points were identified that have a major influence on outcome.
These are:

- Are urgent cases identified in time at different levels of care?
- Does the quality of perioperative care meet the achievable needs?

The development of indicators was focused on two diseases, namely the transposition of the great arteries and the hypoplastic left heart syndrome. In order to develop a quick and cost-effective data collection an existing database was searched. The Centre for Healthcare Information of the Ministry of Health (GYÓGYINFOK) permanently collects the data of Hungarian hospital treatment events. The existing data are suitable for developing the following indicators:

- Hospital mortality caused by hypoplastic left heart syndrome.
- The proportion of newborns with transposition of the great arteries that arrive in a cardiac centre more than two days after birth.
- The postoperative mortality following switch repair of transposition of the great arteries.

3.5. Data Collection

Data collection for measuring how actual performance comply with criteria:
Retrospective data collection was performed including all hospital treatment data concerning Hajdú-Bihar County (Hungary) in a four-year period from January 1, 1994 until December 31, 1997. The reports of paediatric cardiology and obstetric/genetic outpatient clinics, reports of county nurses, and departments of pathology were also surveyed.
Data collection for the development of quality indicators:
The hospital treatment events data were collected of all infants having congenital or acquired heart disease in the year of 1996. Data extraction was made from the database of GYÓGYINFOK. The treatment events of infants with transposition of the great arteries or hypoplastic left heart syndrome were analysed further. Each patient had at least two treatment events. In order to test the reliability of data we matched the diagnoses in case of different treatment events of the same patient and the appropriateness of procedures (e.g. arterial switch operation in case of transposition of great arteries). Data proved to be reliable.

4. RESULTS

4.1. Birth prevalence of congenital heart diseases in Hajdú-Bihar County (Hungary)

During the four-year period altogether 421 congenital heart diseases were recognized in Hajdú-Bihar County. If the number of recognized heart diseases compared to the number of live births the birth prevalence of congenital heart diseases is 15,6 ‰. 81% of the heart diseases were diagnosed under the age of one year.
The more frequent diagnoses were secundum type atrial septal defect, ventricular septal defect and - less commonly - patent ductus arteriosus.
The proportion of „critical heart diseases” is important to determine. Cases required intervention under the age of one year, who had fatal outcome in infancy or associated with cyanosis were considered critical. 66 cases fulfilled the previously mentioned criteria. According to this the birth prevalence of critical heart diseases was 2.5 ‰.

4.2. Correspondence to criteria in the course of care of congenital heart diseases

4.2.1. Critical congenital heart diseases must be identified in time.
During the examined period 66 cases of „critical heart diseases" were recognized. In each case the diagnosis was set up in infancy. Delay (that influenced the outcome) in recognition could be proved in two cases. In a newborn the diagnosis (transposition of the great arteries) was set up post mortem. In the other case the hemitruncus was recognized at the age of two months when pneumonia and respiratory failure complicated the case.
4.2.2. Death must not occur from isolated heart disease in infancy
During the examined four years 28 infants died of congenital heart diseases. In five cases invasive therapeutic procedure preceded the fatal outcome. In 11 cases the serious associated diseases (hydrops, IRDS, Edwards syndrome, sepsis etc.) contraindicated the surgical intervention. In three cases the onset of pneumonia during infancy (between 2 and 7 months of age) led to death. Early intervention may have led to a favourable outcome. In six newborns the associated diseases were serious that definitely altered the prognosis although none of them ruled out the chance of survival (prematurity, poor left ventricular function, other congenital malformation etc.). Two of the six patients had surgical repair. In eight cases no associated disease was recognized. Only three of them had surgical intervention.
4.2.3. Invasive therapy must be accessible for each child who is in need of it.
121 invasive therapeutic procedures (surgical repair or interventional heart catheterisation) were performed in children under the age of 14 in Hajdú-Bihar County during the four-year period. This number means 4,5 procedures/1000 live births. The waiting list has not changed remarkably (32 at the beginning and 29 at the end of the period) indicating that the capacity mentioned above met the needs. 23 infants died without invasive therapeutic procedure. Including these cases the required therapeutic capacity 5,3 procedure/1000 live births. Up to now the required invasive therapeutic capacity in case of congenital heart diseases has not been measured in Hungary. Taking into account the 95 000 live births in Hungary the estimated need of therapeutic procedures is between 428 –504 per year
4.2.4. The correction of the congenital heart disease must be performed at optimal age of the child.
As mentioned above 121 therapeutic procedures (109 operations and 12 interventional heart catheterisations) occurred during the examined period. The 121 procedures were performed on 112 children; seven patients required two procedures while one child went through 3 procedures. 34% of the procedures (41 events) occurred under the age of one year and 11% was performed before the 28th day of life. In case of atrial septal defect (although the correction is not urgent in infant and toddler age) out of 25 corrections 11 were performed on children older than six years. All other heart diseases corrected over the age of one were operated on at more than four years of age in 58% of the cases.
Nowadays the optimal age for correction of congenital heart disease is infant or toddler age.
4.2.5 The postoperative mortality must not be higher than the unavoidable risk
Out of the 121 procedures 10 resulted in death within 30 days postoperatively. This means 8.3 % postoperative mortality. Five of the 41 procedures performed on infants led to a fatal end and also five of the 80 procedures done on children over one year of age had a fatal outcome. 23 infants died without invasive therapeutic procedure. In case of 11 patients the surgery was contraindicated because of additional factors that made the outcome hopeless. In 12 infants the invasive procedure might have led to a more favourable outcome. If we consider that all these infants go through successful procedure, the postoperative mortality would be 7,5 % on the other hand if all of them die in spite of the intervention the postoperative mortality would

be 16,5 %. If the two cases where delayed recognition determined the outcome are not taken into consideration the postoperative mortality rate would be in the range of 7,6 –15,3 %.

4.2.6 The surgical waiting time should not be longer than one year in non-urgent cases

At the beginning of the examination period 32 children were on waiting list while at the end (January 1, 1998) 29. In January 1, 1998 more than one third (11) of the children being on waiting list had been waiting for more than one year. Nowadays the optimal age for correction of congenital heart disease is infant or toddler age.

4.2.7 All congenital heart diseases should be identified.

If the frequency of congenital heart diseases recognized in our study is comparable with other epidemiological studies indicates that all (or nearly all) of the congenital heart diseases are identified.

During the four-year period altogether 421 congenital heart diseases were recognized in Hajdú-Bihar County. If the number of recognized heart diseases compared to the number of live births, the birth prevalence of congenital heart diseases is 15,6 ‰. 81% of the heart diseases were diagnosed under the age of one year.

Previous studies report birth prevalence of congenital heart disease between 3.7 – 11.9 ‰. According to recent studies the prevalence of mild defects is much higher. More than half of the newborns have an interatrial communication and the prevalence of VSD in newborns is 53,2 ‰. These mild defects usually resolve spontaneously.

Owing to the diversity of results we cannot answer the question if all congenital heart diseases were recognized or not.

4.3. Quality aspects of the care of rare, acquired paediatric heart diseases

From the point of view of quality it is crucial if the rare unexpected event is a new, previously unknown phenomenon or a sentinel event indicating problems in the process of care.

Our aim was to perform a detailed analysis of two rare cardiac complications which possess present interest owing to the development of other subspecialties of paediatrics.

4.3.1. Candida endocarditis in a very low birth weight infant

Premature neonates hospitalized in neonatal intensive care units are particularly prone to infection by Candida species. The patient characteristics, the applied treatments and the typical risk factors of intensive care units can all contribute to this susceptibility.

Patient characteristics:

Lymphocytes from premature infants, especially from male infants have reduced capacity to inhibit the growth of C. albicans. Phagocytosis of Candida albicans by leukocytes in premature and mature infants has been shown to be similar to phagocytosis in adults. On the other hand the cytotoxic activity of neonatal macrophages cannot be fully activated by IFN-gamma.

The characteristics of health system's structure:

The increased survival and prolonged stay in intensive care for small premature infants has resulted in a higher workload for nurses, which can lead to a breakdown in asepsis during child handling. This phenomenon has been demonstrated previously during bacterial infections.

Risk factor of the treatment processes:

Premature neonates hospitalized in neonatal intensive care units are particularly prone to fungal infections. Prolonged antibiotic therapy, intubations, intravenous catheterisation, parenteral nutrition and corticoid therapy can all contribute to this susceptibility.

The role of medical decision-making:

On the basis of medical literature the growing risk of candidal infection could have been considered. We chose fluconazol for the treatment of systemic candidiasis in order to avoid the toxic effects of amphotericin B and flucytosine. Fluconazol had only transient effect and could not control the progression of the disease. Similar observation has been reported in

candidiasis occurring in infants. The development of Candida endocarditis in a premature infant while treated with fluconazol has not been reported. The observation provides important knowledge that in spite of antifungal therapy of systemic candidiasis candidal endocarditis may develop. Awareness of this knowledge should have prompted earlier echocardiographic investigation even if no cardiac symptoms are present.

Defining root-cause:

17 premature infants have been previously described with fungal endocarditis. In 15 cases the use of central venous catheter was reported. In our patient an umbilical arterial catheter was placed in for 8 days and afterwards peripheral veins were cannulated. No structural heart anomaly was detected by echocardiography and autopsy. Transient symptomatic ductus arteriosus was treated successfully with indomethacin. In our case none of the mentioned factors – that represent the highest risk - could be observed. We consider that the more significant manifestation of other risk factors mentioned above (inappropriate infection control, problems in decision making) may have played a very important role. In this aspect the case should be considered as “sentinel event”.

4.3.2. Critical evaluation of pericardiac tamponade in childhood

The pericardic tamponade is a well-known complication of certain paediatric diseases (chronic uraemia, postpericardiotomy syndrome etc.). Although it is a rare complication we have experienced it more frequently in the recent years. The relative increase of cases made us to analyse this complication in details.

Patient characteristics:

In two cases chronic uraemia while in other two cases heart surgery, another case stab wound and in another case intrapericardiac teratoma made the patient susceptible to pericardiac tamponade.

The characteristics of health system’s structure:

Pericardiac tamponade is a life threatening disease. The development of diagnostic and monitoring capacity and the availability of heart surgery were important factors of the favourable outcome of this serious complication. The prolonged duration of maintenance haemodialysis increased the risk of the development of uraemic pericarditis. The increased capacity of kidney transplantation would reduce the risk of pericardial tamponade.

Risk factors of the treatment processes:

One factor leading to pericardiac tamponade is inadequate dialysis technique. Proper way of dialysis decreases the risk of uraemic pericarditis and tamponade. Following heart surgery postoperative bleeding or infection are the most important factors causing pericardiac tamponade.

Penetrating chest injury is associated with intrapericardial lesion in about 19% of all cases. Hospital mortality is still high without immediate surgical intervention.

The role of medical decision-making:

Good decision-making requires awareness of the factors that are strongly related to the outcome. In case of rare conditions the lack of scientific evidences makes the proper decision-making more difficult. On literature search only one controlled trial was found concerning pericardiac tamponade. According to this trial the effectiveness of indomethacin in uraemic pericarditis is not proven.

Defining root-cause:

The increased frequency of pericardiac tamponade is due to the wide use of new interventions (haemodialysis, open heart surgery) on one hand and the prolonged survival of patients with severe chronic diseases on the other hand. The increased risk can be counterbalanced by the development of health care infrastructure and by continuous medical education. The review of

our cases showed that pericardiac tamponade is a rare complication in childhood and very different conditions can lead to its formation. Because of this one root cause cannot be identified. From the aspect of quality of care the crucial point is if the diagnosis and treatment occurred in time and in a proper way. None of the cases resulted in death or irreversible impairment of the patient. We have come to the conclusion that the care of the pericardial tamponade was appropriate.

4.4. Quality measurement with quality indicators

According to the database of GYÓGYINFOK 128 infant died of congenital heart disease in hospital in 1996. Among them the most frequent cause of death was hypoplastic left heart syndrome. Transposition of the great arteries was the second in the line. Reasonable parameters were identified as quality indicators, where the measured value of the indicator had inevitable relation with the outcome.

4.4.1. Death owing to hypoplastic left heart syndrome

18 infants died of hypoplastic left heart syndrome in the year of the examination. Cardiologists and pathologists already have the ability to diagnose this disease, on the other hand 8 newborns out of the 18 were discharged from the obstetric departments without the diagnosis of heart disease. Foetal echocardiography is a valuable tool in the early diagnosis of this syndrome. On the other hand promising surgical repair is available as well. The reduction of mortality can be achieved by foetal screening or by successful surgical repair. In the year of the examination the surgical repair was not available in Hungary, consequently the mortality due to hypoplastic left heart syndrome was an indicator of the quality of foetal screening.

4.4.2. The diagnosis of transposition of the great arteries as a quality indicator

Transposition of the great arteries is a serious but already curable disease. The early diagnosis and urgent transfer to a cardiac centre is very important concerning the outcome. In the year the of examination (1996) 46 infants required hospital care for transposition of the great arteries. Among them 17 died in hospital. Out of the 46 cases 35 infants could be followed from birth. Out of the 35 newborns 12 died in hospital. The died and survived infants did not differ in the length of time passed until the arrival to the cardiac centre. We can conclude that the timing of the diagnosis and the transportation were not important factors concerning mortality.

5. CONCLUSIONS

The measurement of the quality of care is essential because of professional, ethical and economic reasons. Criterion based clinical audit and the development of indicators are suitable methods to reach this goal. Critical evaluation of rare events can be performed by the „significant event audit” method.

5.1. Audit criteria

The identification of criteria was done via reviewing the process of care and systematic literature review, combining quantitative and qualitative research techniques.

5.1.1. Critical congenital heart diseases must be identified in time.

During the examined period 10,6% of the infant mortality was due to congenital heart diseases in Hajdú-Bihar County. Abu-Harb et al found congenital heart disease as a reason of death in 9 % of infants while congenital heart disease was recognized post mortem in 30 % of cases. In our study only one case was diagnosed post mortem (3%). These data indicate that screening of congenital heart disease was effective in our region but the treatment did not reach the expectable level.

5.1.2. Death must not occur from isolated heart disease in infancy

This criterion may look idealistic but the numeric value of associated standard will provide us reliable information how actual performance complies with the criterion. Eight infants died of isolated congenital heart disease; five of them were not operated on. All of them had serious heart disease (hypoplastic left heart syndrome, pulmonary valve agenesia, truncus arteriosus, transposition of the great arteries). One case of transposition of the great arteries was not operated on because of the delay in making the diagnosis.

Measuring performance according to this criterion is important to monitor the development of cardiac and surgical care.

5.1.3. Invasive therapy must be accessible for each child who is in need of it.

As a result of our study 4,5 - 5,3 invasive procedures/1000 live births are needed in Hungary. Grech et al published similar results (4,2/1000 live births). During the examination period the surgical capacity did not meet the needs in Hungary.

5.1.4 The correction of the congenital heart diseases must be performed at optimal age of the child.

In our county 34% of the procedures (41 events) occurred under the age of one year and 11% was performed before the 28th day of life. In the United States half of the correction occurred under the age of one, while 25% was performed in newborn period (before 28th day of life) already in the late eighties. The age of children at the time of correction was relatively high in Hungary in the examined period.

5.1.5 The postoperative mortality must not be higher than the unavoidable risk

The postoperative mortality is an important indicator of the quality of care, but – because of several influencing factors – its appreciation is difficult. The most questionable point is that the severity of cases is variable altering the risk of the procedure. In 1994 the overall postoperative mortality in case of congenital heart diseases in infants and children was 8,1 % in the United States. In Hajdú-Bihar County, during the examined period, 8,3 % of patients died postoperatively (within 30 days). The selection of patients for operation may influence the comparison of results. In the examined population 12 more infants would have been selected for the invasive procedure in our regoin. If we consider that all these infants go through successful procedure, the postoperative mortality would be 7,5 % on the other hand if all of them die in spite of the intervention the postoperative mortality would be 16,5 %. We can conclude that our results are comparable with the results of the United States that has one of the most advanced paediatric heart surgical facility.

5.1.6 The surgical waiting time should not be longer than one year in non-urgent cases

One third of our patients had been on waiting list for more than one year. At the end of the nineties significant capacity extension occurred in the field of paediatric heart surgery in Hungary. Hopefully, we can expect the shortening of the waiting list.

5.1.7 All congenital heart diseases should be identified

One of our fundamental hypothesis was, if the frequency of congenital heart diseases recognized in our study is comparable with other epidemiological studies, it indicates that all (or nearly all) of the congenital heart diseases are identified. Previous studies reported birth prevalence of congenital heart diseases between 3.7 – 11.9 ‰. The birth prevalence of congenital heart diseases in our study was 15,6 ‰, which was higher than the results of previous reports. Question may arise if the prevalence of congenital heart diseases has increased. We consider that the effective screening network, which characterizes the Hungarian primary care and the availability of colour-Doppler echocardiography, resulted in the identification of higher proportion of congenital heart diseases. Guideline submitted by the American Heart Association does not support the complete screening of the child population because it has questionable effect on outcome.

5.2. Quality aspects of the care of rare, acquired paediatric heart diseases

From the point of view of quality it is crucial if the rare unexpected event is a new previously unknown phenomenon or a sentinel event indicating problems in the process of care.
According to Reason there are two main classifications of errors – active and passive. Reason defines active failures as errors in direct contact with the human – system interface. Latent errors are defined as the delayed consequences of technical design or organizational issues and decisions. Reason referred to these latent errors as „organizational pathogens", which lie waiting for the right opportunity to become active. Significant events are the results of the activation of organizational pathogens. Significant event audit is an important tool of quality improvement in paediatric cardiology and heart surgery because of the relative rarity of cases.

5.3. Importance of indicators

Performance evaluation is an unavoidable tool of realizing excellent care. The most feasible method is the systematic use of performance (quality) indicators. Indicators should be used where direct measure of quality is impossible or very expensive. Indicator is a quantitative measure that can be used as a guide to monitor and evaluate the quality of important care and support service activities.

6. ADAPTIBILITY OF RESULTS IN PRACTICE

1. The design of optimal health care should be based on epidemiological results and reliable health needs data. Our study provides essential pieces of information that were not available before in Hungary.
2. The evaluation focused on quality aspect of paediatric cardiology care revealed the strength and weakness that are important for planning future development.
3. Owing to the systematic use of the quality measurement techniques the performance of health care system will be transparent and controllable for financing organizations and for patients too. This will lead to enhanced confidence of people in health care.
4. The applicability of quality measurement techniques was investigated in the field of paediatric cardiology and heart surgery. The study can serve as a model for other quality measurement activities.

7. THE THESIS IS BASED ON THE FOLLOWING PUBLICATIONS

1. **Mogyorósy G,** Soós Gy, Nagy A. Candida endocarditis in a premature infant. **J Perinat Med.** 2000; 28 (5): 407-411. **(IF: 0,616)**
2. **Mogyorósy G**, Belicza É, Karácsonyi T, Szűcs É. [Incidence and invasive treatment of congenital heart diseases in Hajdu-Bihar county] A veleszületett szívhibák incidenciája és invazív kezelése Hajdú-Bihar megyében. **Orv Hetil.** 2000; 141 (23): 1287-1292.
3. **Mogyorósy G,** Belicza É. [Evidence-based medicine in everyday medical practice] A bizonyítékokon alapuló orvoslás a mindennapi orvosi gyakorlatban. **Orv Hetil.** 1999; 140 (21): 1173-1177.
4. **Mogyorósy G,** Belicza É. [Development of quality indicators in paediatric cardiology] Minőségi indikátorok fejlesztése a gyermekkardiológiában. **Pediáter** 1998; 7(4): 308-312.
5. **Mogyorósy** G, Bobok I, Karácsonyi T, Nagy Zs, Péterffy Á. A pericardiális tamponád 6 tanulságos esete. **Gyermekgyógyászat** 2000; 51 (2): 153-157.
6. **Mogyorósy G.** Hemodialízis cardiovascularis hatásának vizsgálata. **Cardiol Hung**. 1993; 22 Suppl: 19-20.
7. **Mogyorósy G,** Kovács I, Sulyok K. [Transient hypertrophic cardiomyopathy as a consequence of mediastinal radiotherapy in a 3-year-old child] Mediastinalis sugárterápia következtében kialakult átmeneti hypertrophiás cardiomyopathia 3 éves gyermeknél. **Orv Hetil.** 1994; 135 (22): 1195-1197.
8. Nagy Zs, **Mogyorossy G,** Péterffy Á. Traumatic ventricular septal defect and mitral incompetence in a 5-year-old child. **J Trauma.** 1999; 46 (4): 727-728. **(IF:1,752)**

8. OTHER PUBLICATIONS

1. **Mogyorósy G,** Sulyok K, Karmazsin L. Szívritmuszavarok a gyermekkorban. **Gyermekgyógyászat.** 1989; 40: 1-17.
2. Sulyok K, **Mogyorósy G.** Tensiomin jelentősége a gyermekkori dekompenzáció kezelésében. **Gyermekgyógyászat** 1990; 41: 259-266.
3. **Mogyorósy G,** Sulyok K. Az újszülött-, csecsemő- és gyermekkori szívritmuszavarok osztályunk anyagában. **Gyermekgyógyászat** 1990; 41: 409-416.
4. **Mogyorósy G.** A táplálás és kalorizálás szerepe csecsemőkori kardiológiai megbetegedésekben. **Gyermekgyógyászat** 1995; 46 Suppl 1: 81-86.
5. **Mogyorósy G,** Bobok I, Sulyok K, Szabó Béla. Plazmaferezis sikeres alkalmazása súlyos Melipramin mérgezésben. **Gyermekgyógyászat** 1995; 46 (4): 375-380.
6. Hajdú J, Marton T, Tóth Pál E, Papp Cs, Oroszné Nagy J, **Mogyorósi G** és Papp Z. Szívfejlődési rendellenességek és szívműködési zavarok: hogyan változtatta meg a praenatalis diagnosztika a túlélés esélyeit. **Orv Hetil**. 1999; 140 (15): 815-818.
7. Czok M, Hajdú J, Harmath Á, **Mogyorósi G.** Kawasaki-syndroma újszülöttkori diagnózisa és eredményes kezelése. **Gyermekgyógyászat** 2000; 51 (1): 77-80.
8. Kovács T, **Mogyorósy G**, Nagy A, György I. Magzati supraventricularis tachycardia, mint a sclerosis tuberosa első jele. **Gyermekgyógyászat**. 2000; 51 (2): 163-167.