

## PedsCases Podcast Scripts

This is a text version of a podcast from PedsCases.com on "Evaluation of a Heart Murmur." These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at [www.pedsCases.com/podcasts](http://www.pedsCases.com/podcasts).

### **Evaluation of a Heart Murmur**

This podcast was written by Dr. Andrew Mackie, a pediatric cardiologist at the Stollery Children's Hospital. Dr. Mackie is an Assistant Professor in the Departments of Pediatrics and Public Health Sciences at the University of Alberta.

The objectives of this podcast are three-fold:

1. First, to help the learner identify clinical features that distinguish an innocent from a pathologic murmur.
2. Second, to recognize common innocent and pathologic murmurs using some audio examples.
3. And third, to feel comfortable explaining to parents what an innocent murmur is.

Heart murmurs are very common in the general pediatric population. At least 50% of children have a murmur at some point in childhood. In fact of newborns examined every day for the first eight days of life, found that 77% had a heart murmur. Although heart murmurs are very common in infants and healthy children, the prevalence of congenital heart disease in the pediatric population is much lower; approximately 1%. Therefore, the great majority of children with murmurs have normal hearts. These children have innocent murmurs.

Because heart murmurs are common in children, murmur evaluation is a common clinical scenario for the clinician. This is true for family physicians, general pediatricians, and pediatric cardiologists. The presence of a murmur is the most common reason for referral to pediatric cardiology.

Becoming comfortable with murmur evaluation in children is a skill that takes time and practice. However, examination of the cardiovascular system involves much more than just evaluation of murmurs. The complete cardiovascular examination includes observation and general inspection, looking for dysmorphic features or cyanosis; examination of the extremities, paying attention to the amplitude and contour of pulses, examining perfusion, looking for clubbing, and examining the precordium; both in terms of inspection and palpation, as well as auscultation. Examination of the cardiovascular system also includes an examination of the liver and spleen. However, for the purpose of this podcast, we will focus on auscultation. Auscultation includes paying attention to the first and second heart sounds; in normal, healthy children the second heart sound splits physiologically during

inspiration, as P2 (closure of the pulmonary valve) becomes delayed relative to A2 (closure of the aortic valve). I will play an example of normal physiologic splitting of the second heart sound right now.

With regards to murmurs, the clinician needs to pay attention to the timing of a murmur, be that in systole or diastole, and more specifically pansystolic or early-to-mid systolic, early diastolic, mid-to-late diastolic, and so on. They also need to pay attention to the location and radiation of a murmur, the quality of a murmur; for example, a harsh, soft, or musical; and the intensity of a murmur which is scaled on a scale of I-VI.

Next, I am going to describe some characteristics that are typical of innocent murmurs. Likewise, I will provide you some features typical of pathologic murmurs.

In general, innocent murmurs have the following features. They are crescendo/decrescendo in shape; they are systolic in terms of timing; they are soft or vibratory in quality; they are grade III in intensity or less; they are associated with a normal second heart sound and they are not associated with extra sounds such as an opening snap or ejection click.

On the other hand, pathologic murmurs may be systolic or diastolic. In fact, diastolic murmurs are always pathologic. Murmurs that are holosystolic are also pathologic. Pathologic murmurs are also more likely to be harsh, and may be of intensity IV/VI or higher; in other words, associated with a thrill. Pathologic murmurs may be associated with an abnormal first or second heart sound, or other abnormal sound such as a click or opening snap, and they may increase in intensity when the patient stands, such as the murmur of hypertrophic cardiomyopathy. Of course, other abnormalities of the cardiovascular system may coexist with the presence of pathologic murmurs; these include increased precordial activity, weak or absent femoral pulses, and the presence of cardiac symptoms.

I am now going to play you some examples of common innocent murmurs: The first is a Still's murmur. This is typically heard between two and seven years of age. It is characteristically of vibratory or musical sound in early to mid-systole that is medium to low pitched and may be grade I, II, or III in intensity and is loudest at the left lower sternal border, the apex, or midway in between. It is typically louder in the supine position compared to the sitting position, and will become softer in intensity or disappear with Valsalva maneuver. Like any innocent murmur, it will become louder with exercise, anemia, or a fever. The etiology of this sound is uncertain. Here is an example now.

Another common murmur is the pulmonary flow murmur. This is typically heard in older children and adolescents. It is also common in healthy pregnant women. It is low-to-medium pitched, crescendo/decrescendo in shape, is heard in early-to-mid systole, and is sometimes described as blowing in quality. It may be grade I, II, or III

in intensity. It is loudest at the left upper sternal border, radiating to the lung fields. It is louder in the supine position and with inspiration. Here is an example.

The cervical venous hum is another common innocent murmur, typically in the two to seven- year-old age group. It is a continuous rumbling sound at the sternoclavicular junction, either on the right or left side. It is typically louder on the right side and is accentuated by turning the head away from the side of the murmur, and lifting the chin; in other words, by turning the head to the left and lifting the chin slightly if listening at the right SC junction. On the other hand, a cervical venous hum will disappear or become quieter by pressing lightly over the jugular vein and will disappear by having the child assume the supine position.

A carotid bruit is also a common innocent sound in children that can be heard at age two or higher. It is a crescendo/decrescendo, short, midsystolic sound over the carotid arteries. It is not affected by posture, and importantly in children it must be distinguished from aortic or subaortic stenosis that is radiating to the carotid arteries.

Finally, peripheral pulmonary stenosis is a physiologic sound that is commonly heard in healthy infants in the first six months of life. It is especially common in premature infants. It is a blowing, high pitched, short mid-systolic sound, often heard best in the axilla or over the lung fields, and is sometimes heard in the lung fields more readily than over the precordium; however, if it is heard over the precordium, it is loudest at the left upper sternal border. It is not affected by the baby's position. Here is an example.

I am now going to play some examples of common pathologic murmurs, beginning with a ventricular septal defect. This sound can be heard at any age, although it is often not heard in the first few days/weeks of life. It is typically a pansystolic or harsh murmur, although small muscular ventricular septal defects can close on themselves prior to the end of systole; so sometimes they are heard only in early-to-mid-systole. They are usually grade II, III, or IV in intensity. They are low-to-high pitched, depending on the right ventricular pressure, and may be associated with other cardiac symptoms and physical findings depending on their size. Here is an example.

Next, is the atrial septal defect. This murmur can be heard at any age, is typically grade I, II, or III in intensity, and is medium-to-low pitched. It is a crescendo/decrescendo murmur heard best at the left upper sternal border and radiating to the lung fields. Importantly, it is associated with abnormal splitting of the second heart sound, namely wide, fixed splitting. It does not decrease in intensity by having the patient sit up or stand, and it may be associated with a diastolic rumble, or increased precordial activity. Here is an example.

Pulmonary valve stenosis can be heard at any age. It is a crescendo/decrescendo murmur, and like an atrial septal defect is also heard best at the left upper sternal

border, and radiates to the lung fields. However, unlike atrial septal defects, pulmonary valve stenosis is associated with a variable early systolic ejection click, heard in expiration but often not heard in inspiration. Here is an example.

Another common pathologic murmur is a patent ductus arteriosus, which can be heard at any age, and results in a continuous murmur, typically heard at the left upper sternal border and underneath the left clavicle. This murmur is often described as a machinery-like noise, and does not vary with position of the baby or child. Unlike a continuous murmur of a cervical venous hum, it does not disappear in the supine position, and cannot be accentuated with change of the head position.

Aortic valve stenosis, like pulmonary valve stenosis, is a harsh crescendo/decrescendo murmur associated with a click. However, aortic valve stenosis differs from pulmonary stenosis in several ways; the murmur is typically loudest at the right upper sternal border, and may radiate to the carotid vessels. The click of aortic valve stenosis does not vary with the respiratory cycle, unlike that of pulmonary valve stenosis. Finally, aortic valve stenosis may be associated with an early diastolic decrescendo murmur of aortic regurgitation. Here is an example of aortic stenosis.

Here is an example of a person with bicuspid aortic valve, and an ejection click resulting from the bicuspid valve, without aortic stenosis. There is a click but no murmur.

There are other pathologic murmurs that can be heard in children, including the murmurs of aortic regurgitation, mitral regurgitation and mitral stenosis, but are beyond the scope of this podcast.

For the final few minutes, I would like to make some comments about explaining innocent murmurs to parents. The explanation provided by physicians greatly influences the degree of parental anxiety related to heart murmurs. There are many ways to do this of course. Here are some examples of statements that I have found helpful in explaining innocent murmurs to parents:

I explain, first of all, what a heart murmur is; that a murmur is simply an extra sound made by the heart, and that this definition does not imply the presence of a heart abnormality. I reassure them that murmurs are very common in healthy children, and I may say something like "heart murmurs are heard in about half of children, but only about 1/100 of children actually have a heart problem, and therefore most children with heart murmurs have perfectly normal hearts." I then add that children with heart murmurs and normal hearts have innocent murmurs, meaning non-guilty, and that these are normal sounds. I say that these normal sounds are caused by vibration of the muscles of the heart, or by normal flow of blood out of the heart. Parents will often wonder how long the murmur will last for, and whether or not it will disappear, and my response to that typically is that whether or not an innocent murmur disappears

simply does not matter, because innocent murmurs are not diseases, they are normal sounds. I reassure parents that their child, when old enough to participate in sports, including competitive sports, will be able to do so without restriction. I like to say the word normal at least five times before the family leaves, as I find that this is necessary to provide sufficient explanation and reassurance to parents.

Finally, a few comments about when children with murmurs ought to be referred to a pediatric cardiologist: First of all, any murmur that is suspected to be pathologic by the referring physician should, of course, be referred. If there is lingering uncertainty about a murmur being either innocent or pathologic, then of course that is also a reasonable situation. If there is a murmur and a family history of congenital heart disease in an immediate family member, such as a sibling or a parent, or if there is a murmur and family history of Marfan syndrome or sudden death in a young person, then those are appropriate reasons for referral to pediatric cardiology. In addition, if there is a murmur and a known or suspected syndrome such as trisomy 21 or other chromosomal or genetic conditions, then that is an appropriate reason to refer to cardiology. Finally if the parents are requesting a cardiology referral, then I would encourage you to take them up on that.

I hope this podcast has been helpful. Good luck with your auscultation. It takes experience to become comfortable with murmur evaluation, but this skill can be a very rewarding part of clinical practice.

### References

References available upon request.