

Anaesthesia recommendations for **Williams syndrome**

Disease name: Williams syndrome

ICD 10: ./.

Synonyms: Williams-Beuren syndrome

Disease summary: Williams syndrome (WS) results from micro deletion of contiguous genes at chromosome 7q11.23 [1]. This genome part includes several genes [2] like ELN (ELastiN) encoding the tissue structural protein elastin [3] and Gtf2i (General transcription factor II-I) encoding a multifunctional phosphoprotein with roles in transcription and signal transduction [4]. This results in a multisystem disorder involving the cardiovascular [5], connective tissue and central nervous system. The incidence of typical forms is 1/20 000 people [6]. The clinical description associates a supravalvular aortic stenosis and/or a stenosis of the branches of pulmonary arteries, a psychomotor retardation and a facial dysmorphism [7,8]. The association with neonatal hypercalcemia has also been reported [9]. The facial dysmorphism is characterized by an elfin facies syndrome: stellate pattern of the irises [10], broad forehead, periorbital fullness, high and rounded cheeks, pointed chin, flattened nasal bridge and upturned nose, long philtrum and wide and everted lower lip [11]. The most frequent orofacial alteration is malocclusion (94%) [12]. In addition to the psychomotor retardation, these patients have a disharmonious IQ (Intelligence Quotient) profile in favour of verbal test [13]; they are hyper social and have major anxiety [14,15]. They also have musical abilities [16,17]. Cardiovascular abnormalities are common in WS [18]; most of them are arterial stenosis. Forty-five to 75% of WS patients suffer from supravalvular aortic stenosis and/or pulmonary arteries stenosis. Eighty percent of WS patients have cardiac abnormalities (aortic, mitral and/or tricuspid valves abnormalities, ventricular hypertrophy), they also have coronary artery abnormalities [19]. Systemic arteriopathy in other vessels in the body occur in 20% of cases, preferentially on the thoracic aorta (which can be associated with renal artery stenosis), but other sites are possible (neck, limbs abdominal aorta...). Most of the cardiovascular abnormalities are found in the first year of life [11]. They also can suffer from endocrine dysfunction [20,21], pulmonary emphysema [2], ophthalmologic manifestation [22,23] or epilepsy [24].

Medicine is in progress



Perhaps new knowledge

Every patient is unique

Perhaps the diagnosis is wrong



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Typical surgery

Most of the surgical procedures in patients with WS occur during childhood [18]. Recent advancements in medical and surgical field have improved life expectancy and therefore both adult and paediatric patients with WS present for surgical procedures. Most common procedures include:

- Dental avulsion: hypoplasia of the email increase the prevalence of cavities [25],
- Scoliosis surgery [26,27],
- Strabismus surgery [22],
- MRI.

Type of anaesthesia

Both sedation and general anaesthesia can be performed; it is necessary to privilege the sedation whenever it is possible [28]. The risk of an adverse cardiac event during general anaesthesia is high: 11% [29]. Depending on age and surgery, peripheral locoregional anaesthesia seems a good choice. Spinal anaesthesia can be performed depending on favourable cardiologist evaluation.

Necessary additional pre-operative testing (beside standard care)

Evaluation by a cardiologist within one month of the procedure is recommended [28,30]. This evaluation should include [18]:

1. A physical examination with blood pressure at two arms and two legs: Echocardiography may not demonstrate a stenosis but it can be demonstrated with diminished pulses and blood pressure in lower extremities [31].
2. An ECG: looking for arrhythmias and/or QTc prolongation [32,33], history of ischaemia [19]. Consultation of an electrophysiologist if needed.
3. An echocardiography: looking for cardiac abnormalities [19].
4. Screening for thyroid dysfunction [20,34] and diabetes disorders [21] and, in early childhood looking for an hypercalcemia.

Particular preparation for airway management

In literature, WS facial abnormalities [12,28] are not associated with either difficult intubation or ventilation.

Particular preparation for transfusion or administration of blood products

No specific preparation is required for administration of blood products.

Particular preparation for anticoagulation

No specific preparation is required regarding anticoagulation.

Particular precautions for positioning, transportation and mobilisation

No specific precautions are required for positioning, transport or mobilisation.

Interactions of chronic disease and anaesthesia medications

Betablocker therapy should not be stopped.

Antiepileptic therapy should not be stopped.

Angiotensin Converting Enzyme Inhibitor should be stopped.

Anaesthetic procedure

Anaesthesia for patients with WS should be performed in a centre where cardiologist and intensivists and a (paediatric) cardiac intensive care unit are available. The risk of adverse cardiac events during general anaesthesia is high: 11% [29]. This risk may be reduced if the diagnosis is known before the surgery [35,36]. Patients at highest risk are those with supra valvular aortic stenosis.

Information on preprocedural management have already been published [28] and name: hospital admission the night before the procedure, limit period without fluid intake to two hours or begin maintenance intravenous fluid especially in patients under five years of age. Scheduling the case to be the first case of the day, thus limiting NPO time, is recommended.

Anxiety [15] is a specific characteristic of WS, it can be accompanied by tachycardia and must be considered as such. Pharmacological and non-pharmacological techniques must be used to reduce anxiety. Premedication is recommended to decrease anxiety. If not possible, patients with WS should be comforted by the presence of family or familiar guardian until the loss of consciousness. Particular attention must be provided for noise, as these patients are extremely sensitive to it [17]. The operating room must be quiet at the induction of anaesthesia [28].

Intravenous induction should be preferred to facial mask induction with sevoflurane [28,29]. Topical anaesthesia for venous catheter placement should be considered before anaesthesia. Experts [28] avoid propofol because of its haemodynamic effects which can be catastrophic in WS patients with supra valvular aortic stenosis (hypotension, coronary ischaemia...). A combination of ketamine and midazolam seems to be a wise choice.

Some experts recommend to avoid succinylcholine because of a theoretical risk of a hyperkalaemic response [34], but no case has been published so far. Titrating neuromuscular blockade is accomplished with intraoperative monitoring of train of four.

It is important to mention the Kounis syndrome [37] that can occur in these patients leading to sudden death. The coronary lesions in Williams syndrome may be responsible for the occurrence of sudden death, cardiac arrest during anaesthesia [38–40].

Particular or additional monitoring

Monitoring of the electrocardiographic ST segment with a five lead electrocardiograph is recommended [28].

Four extremity blood pressure measurement should be done before and after anaesthesia/sedation; looking for an undiagnosed stenosis [28].

Haemodynamic goals: maintain sinus rhythm at an age-appropriate heart rate; ensure an adequate preload while avoiding rapid shifts in intravascular volumes and treat hypotension aggressively [41]. Invasive measurement of blood pressure can be considered based on the patient's cardiac condition and type of surgical procedure. The target for blood pressure is the same as for the patient without WS.

The anaesthesiologist should use a cardiovascular monitoring based on the surgical procedure. A transoesophageal echocardiography is recommended for cardiac surgical procedures. Near Infrared Spectroscopy can be helpful to estimate the tissue oxygenation of brain and somatic areas for both cardiac and non-cardiac procedures.

Monitoring the depth of anaesthesia with a specific tool (bi-spectral index, entropy, density spectral array...) is strongly recommended to have an adequate level of anaesthesia and prevent anaesthetic's vascular effects.

In early childhood, the risk of hypercalcemia imposes regular evaluation of the serum calcium [9,28].

Possible complications

Patients with WS should be considered at risk for myocardial ischaemia [28].

WS patients have an increased risk of arrhythmias [32].

WS patients have an increased risk of cardiac arrest [29].

Post-operative care

WS patient should stay in the recovery room and the monitoring should be continued until the patient has recovered near baseline cognitive and cardiovascular function. The presence of family or familiar guardian should be encouraged. For heavier and/or complicated procedure post-operative care must be pursued in intensive care unit.

Disease-related acute problems and effect on anaesthesia and recovery

Disease triggered emergency-like situations are not common in WS.

Ambulatory anaesthesia

Ambulatory anaesthesia should not be considered.

Obstetrical anaesthesia

No data have been found in literature.

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