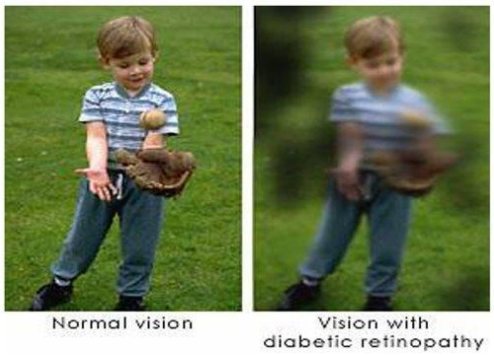
Pediatric Endocrinology Fact Sheet

Long Term Complications of Diabetes

- **Hemoglobin A1c (glycosylated hemoglobin) reflects your average blood glucose over the last approximately 90 days. It measures how much sugar is attached to your red blood cells.**
    - Diabetes range greater than >6.5%
    - Target for diabetes varies based on your type of diabetes and your age so check with your healthcare provider for your specific target. In general, the goal is for hemoglobin A1c to be less than 7.0% as this can significantly decrease the risk of long-term complications.
- Higher average blood sugars lead to higher hemoglobin A1c
- Long term, higher A1c makes your blood "stickier" (as an analogy compare syrup to water) making it harder to get blood flow to small blood vessels that lead to various organs.
- Periodic blood work helps your healthcare provider screen for complications and start treatment early if complications are detected.

Prolonged elevations in A1c can lead to problems with the following organs

- Eye: Diabetic Retinopathy
    - The retina is a light-sensitive tissue at the back of the eye that converts light to nerve signals that the brain interprets as an image
    - Long term, elevated A1c decreases blood flow to the retina and damages the retina.
    - Final complication: progressive blurring of vision and eventual blindness
    - Screening test: Yearly retinal exam



- Kidney: Diabetic Nephropathy
    - The kidney filters the blood to create urine and prevent buildup of any one element. Normally there is a tight barrier so only small molecules like electrolytes and glucose get through but larger molecules like proteins stay in the blood.
    - Long term, elevated A1c breaks down this barrier so that proteins are detectable in the urine. This makes the kidneys less effective in filtering the blood.
    - Final complication: dialysis (having a machine filter your blood) or kidney transplant
    - Screening test: urine microalbumin check
- Nerves: Diabetic Neuropathy
    - Decreased blood flow to the body's nerves leads to numbness, tingling, pain, weakness, and eventual loss of feeling
    - The longest nerves of the body are usually affected first. These include nerves to the hands, feet, digestive tract, and sex organs.
    - Screening test: Foot sensation exam
    - Final complication: chronic pain and decreased sensation. There is an increased risk for infection due

to decreased sensation and injury. If the infection is bad enough combined with decreased blood flow to the area, the body part may need to be amputated (surgically removed) to control the infection.

- Heart: Cardiovascular disease
    - High cholesterol deposits in the walls of blood vessels making them smaller. This further decreases blood flow to organs that are already getting lower flow due to high hemoglobin A1c.
    - Lack of insulin decreases fat and cholesterol handling by the body making it more likely for you to have high cholesterol levels.
    - A well-balanced diet of all your nutrients and exercise increase fat and cholesterol handling by the body making it less likely for you to have high cholesterol levels.
    - Screening test: blood pressure at every visit and lipid panels as indicated by your diabetes care team.
    - Final complication: heart attack or stroke
- Gastrointestinal: Gastroparesis
    - Poor blood flow to the stomach and intestines leads to delay of food movement through the intestinal tract. This can lead to feeling full early, vomiting and weight loss.
    - Screening: no specific test, based on symptoms

If your blood sugars are running high, discuss your diabetes management with your healthcare provider to get blood sugars more in target range!

References

1. American Diabetes Association Professional Practice Committee; *Standards of Medical Care in Diabetes—2022*. *Diabetes Care* 1 January 2022; 45 (Supplement_1).

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