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Nonalcoholic Fatty Liver Disease

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Introduction

Nonalcoholic fatty liver disease (NAFLD) is the most common chronic liver disease in the United States (McCance, Huether, Brashers, & Rote, 2014, p. 1461). Historically, NAFLD primarily affected adults; however, Berardis and Sokal (2014) identified NAFLD has also become the most common cause of chronic liver disease among children and adolescents in Western countries (p. 131). In association with rising rates of childhood obesity, the prevalence of children with NAFLD has more than doubled in the last two decades with the most recent estimate for NAFLD at 9.6% of the general pediatric population (Kohli et al., 2016, p. 9). While the disease process itself does not cause significant illness directly, children and adolescents with NAFLD are at much higher risk for serious chronic illnesses long term.

Risk Factors

The primary risk factor in the development of NAFLD is obesity, specifically increased levels of adipose tissue. Other risk factors include elevated triglyceride levels, elevated cholesterol levels, and insulin-resistance either with or without type 2 diabetes mellitus.

Signs & Symptoms

NAFLD is usually asymptomatic; however, certain individuals may experience:

- Enlarged liver
- Fatigue
- Pain in the right upper abdominal quadrant (Mayo Clinic, 2018)

Changes at the Cellular Level

NAFLD develops when liver cells become infiltrated with fat. Under the microscope, these hepatocytes contain visible amounts of fat within the cell membranes. Visible signs of inflammation may be present also if NAFLD has begun to progress to nonalcoholic steatohepatitis (NASH).

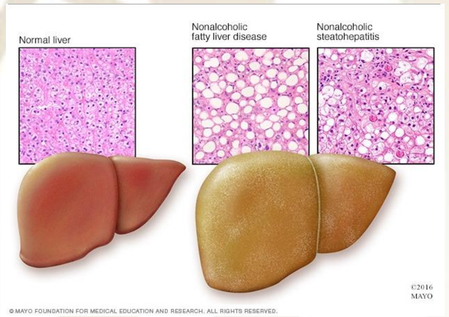

Figure 1. Comparison of normal and fatty liver cells. From *Nonalcoholic fatty liver disease* by Mayo Clinic, 2018. Retrieved from https://www.mayoclinic.org/diseases-conditions/nonalcoholic-fatty-liver-disease/symptoms-causes/syc-20354567

Underlying Pathophysiology

In its healthy state, the liver is able to synthesize, catabolize, and store triglycerides and fatty acids (FFA) to be used as energy by the rest of the body. In moderation, the liver is able to break down triglycerides into glycerol and FFA and store any unneeded supplies until they are needed at a later time. However, if the liver is unable to process excess quantities of these molecules, the surplus of triglycerides and/or FFAs are stored in hepatocytes as fat. The organelles in these cells become disrupted as large vacuoles of fat form within the cell membrane (McCance et al., 2014).

Causes of hepatic triglyceride accumulation include: increased delivery of free fatty acids to the liver, increased lipogenesis, and impaired fatty acid metabolism in hepatocytes (Berardis & Sokol, 2014, p. 132). Increased delivery of FFAs may be the result of increased dietary intake or the release of FFAs from adipose cells.

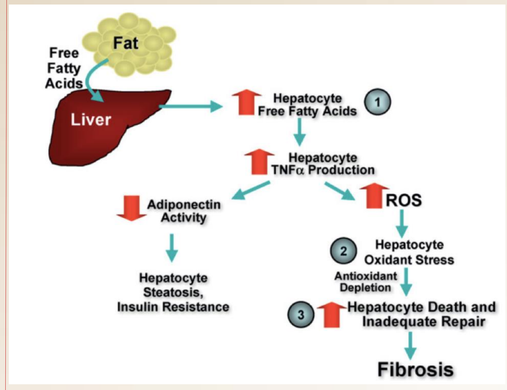

Figure 2. Pathophysiology of nonalcoholic fatty liver disease. From "Mechanisms of Disease Progression in Nonalcoholic Fatty Liver Disease" by J. Jou, S.S. Choi, & A.M. Diehl, 2008, *Seminars in Liver Disease, 28,* 371.

Triglyceride accumulation occurs both in the liver as well as elsewhere in the body and contributes to the formation of adipocytes and adipose tissue. With increased adiposity comes a decreased level of serum adiponectin which increases hepatic glucogenesis and decreases skeletal muscle glucose uptake. This increase in levels of glucose as well as decrease in level of consumption contribute to further metabolic disruption and additional lipogenesis. In addition to releasing FFAs, adipose tissue also releases a number of inflammatory markers including TNF-α and IL-6 which contribute to further metabolic disruption (McCance et al., 2014).

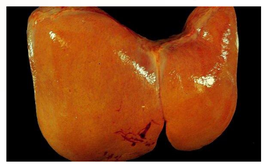

Figure 3. *Fatty liver. "Liver and Biliary Disease."* (n.d.). Retrieved July 16, 2018 from http://www.pathguy.com/lectures/fatty_liver.jpg

Significance of Pathophysiology

As NAFLD is often asymptomatic, it can be present for years before it is detected. This chronic, underlying condition has the potential to progress to serious, life-threatening illnesses. If not addressed. NAFLD has the potential to progress to the following conditions:

Nonalcoholic Steatohepatitis

Nonalcoholic steatohepatits (NASH) occurs when hepatocytes become injured by stored fats and inflammatory processes take over leading to the recruitment cells in the innate immune system including: Toll-like receptors (TLRs), Kupffer cells (KCs), lymphocytes and neutrophils and possibly inflammasome (Farrell, van Rooyen, Gan, & Chitturi, 2012, p. 149). The effects of NASH are destruction of liver cells with possible progression to fibrosis which leads to decreased liver function.

Cirrhosis

If the inflammation and fibrosis continue, damage in the liver can progress to cirrhosis. Cirrhosis occurs when fibrous tissue replaces damaged hepatocytes, leading to further decrease in liver function. Cirrhosis is the twelfth leading cause of death in the United States and can lead to portal hypertension and jaundice (McCance et al., 2014, p. 1460).

Liver Cancer

Further damage to the liver can result in the formation of malignant neoplasms or hepatocellular carcinoma. Although cirrhosis is not a direct cause for all cases of liver cancer, it is a significant and preventable risk factor that leads to a potentially-fatal condition. The American Cancer Society estimates ~42,000 individuals will be diagnosed with primary liver cancer in 2018 and of those individuals, ~30,000 will die from this illness (American Cancer Society, 2018).

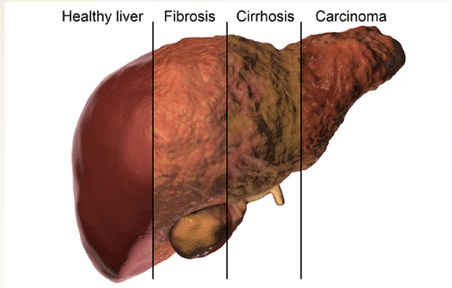

Figure 4. Progression of liver damage. From *Fatty liver disease* by Fact Dr., 2018. Retrieved from https://factdr.com/health-conditions/fatty-liver-disease/

Damage to the liver may also result in disease processes in other body systems. Once the liver has become damaged, the affected individual is at risk for the following conditions:

Insulin Resistance

Increased levels of free fatty acids associated with NAFLD have been linked to the disruption of intracellular insulin signaling, decreased tissue responses to insulin, and alterations in insulin incretin and glucagon secretion (McCance et al., 2014, p. 739) placing these individuals at risk for the development of type 2 diabetes mellitus and its associated metabolic complications.

Atherosclerosis

Liver dysfunction and elevated levels of serum cholesterol levels as well as the release of inflammatory cytokines related to chronic inflammation are associated with endothelial damage that can lead to the formation of atherosclerotic plaques.

Portal Hypertension

Damage to the liver and its associated formation of scar tissue contribute to obstruction and remodeling of the portal venous system; this ultimately leads to portal hypertension and its associated complications which affect multiple body systems. Complications include: varices, splenomegaly, hepatopulmonary syndrome, ascites, and hepatic encephalopathy which may lead to fatal hemorrhage, thrombocytopenia, respiratory complications, electrolyte imbalances, infection, and mental status changes (McCance et al., 2014, p. 1452-1454)

Implications for Nursing Care

Because there is no treatment for NAFLD, education plays a key role in the prevention and management of NAFLD in children, adolescents, and adults. Both registered nurses (RN) and advanced practice nurses (APN) are valuable resources to provide education to patients and families to prevent further damage initiated by NAFLD. Important education topics include education about dietary changes, promotion of physical activity, and the importance of screening tests and imaging procedures.

While some studies have examined specific nutrients to determine if certain foods place individuals at higher risk for NAFLD, Anderson et al. (2016) found that overall higher energy intake in childhood and early adolescents is associated with greater risk for NAFLD while the types of macronutrients are less important (p. 988). With this in mind, RNs and APNs should focus on moderation rather than restriction when providing education about healthy diets to their patients.

Anderson et al. (2015) found increased exercise in in late childhood and lower fat mass in adolescence is linked to lower risk of ultrasound scan fatty liver and liver enzymes indicative of NAFLD (p. 116). In day-to-day clinical practice, RNs and APNs have valuable patient contact and are in pivotal roles to spend time educating their patients about lifestyle interventions including the importance of physical activity. Even if not the primary purpose of the contact, nurses should include questions about physical activity in their assessments. These questions allow nurses to determine where gaps exist and education about the importance of exercise may be beneficial in the prevention of NAFLD and many other chronic conditions.

APNs should also be knowledgeable about basic screening, laboratory, and imaging procedures related to widespread metabolic conditions including NAFLD. By incorporating regular blood testing, including lipid profiles, glucose tests, and hepatic function panels in their assessments, APNs may be able to identify high-risk individuals and target specific interventions before the disease progresses. In addition, APNs should know that liver scans have proven reliable to assess the amount of liver damage in individuals; however, Anderson et al. (2016) found liver scans have proven more useful in the detection of moderate-severe hepatic steatosis and are less able to determine mild fat infiltration (p. 115). This may lead to further progression of the disease if providers rely on this procedure for early detection. Liver biopsy has been identified as the "gold standard" to diagnose NAFLD (Berardis & Sokal, 2014, p. 134); however, it does impact individuals more significantly than less invasive procedures. Due to the risks for complications, biopsies should only be considered when absolutely necessary.

Conclusion

NAFLD is an often silent disease with serious health risks. If action is not taken to halt its pathologic processes, NAFLD may cause serious damage to the liver and other body systems. The importance of interventions related to energy intake and physical activity in obese children is well documented in the literature, citing the reduction of adipose tissue and the development of lean body mass as important processes to improve insulin sensitivity and decrease free fatty acids from entering the liver (Anderson et al., 2016, p. 111; Anderson et. al., 2015, p. 983) and ultimately leading to the development of NAFLD. By performing educational interventions in the form of promoting healthy diets and increased physical activity, RNs and APNs may be able to help children and adolescents decrease these risk factors, resulting in decreased incidence and/or progression of NAFLD and lead to better qualities of life long term.

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