Antenatal exposure to e-cigarette vapor as a possible etiology to total colonic necrotizing enterocolitits: A case report

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Abstract

Antenatal exposure to cigarette smoke is associated with preterm births, low birth weights, and pediatric lung disease. This case report is the first documented potential adverse effect e-cigarettes to a fetus.

1. Case report

Surgical consultation was obtained on a term 1-day-old infant male in the Newborn Intensive Care Unit for abdominal distention and respiratory distress. Physical exam demonstrated a distended abdomen with upper abdominal tenderness. Abdominal X-rays revealed extensive pneumatosis intestinalis without free-air. It was then elected to place the infant on broad-spectrum antibiotics with gastric decompression. In the ensuing 24 h, the abdomen became increasingly erythematous and the infant required mechanical ventilation and pressor support thus he was taken to the operating room for emergent abdominal exploration. Intraoperative findings included normal appearing small bowel however the ascending, transverse, and descending colon had patchy areas of superficial necrosis that were oversewn. There was no evidence of a frank perforation. A double barrel ileostomy was also performed to allow for full diversion of the fecal stream. The child made steady improvement with resolution of septic symptoms and eventually was started on full feeds and discharged from the hospital. A suction rectal biopsy was performed and ruled out Hirschsprung’s disease as a possible etiology of profound and isolated colonic necrotizing enterocolitis.

During a later interview with the parents, it was discovered that the mother had been consistently smoking an e-cigarette throughout the pregnancy—from 30 to 50 times per day. In addition, during the time of active labor, she smoked the e-cigarette approximately 50–70 times. This led to suspicion of whether this was the etiology of the colonic pathology.

In the ensuing weeks, the infant returned the hospital on several occasions for gastrointestinal bleeding via the ostomy that was self-limiting. At seven weeks of age, the infant returned to the operating room for an ileostomy takedown and intraoperative enteroscopy for the occasional gastrointestinal bleeding. A superficial area of mucosal erosion was discovered and oversewn. Also discovered was an extensive stricture in the large intestine from the ascending colon all the way to the peritoneal reflection of the sigmoid colon. A subtotal colectomy was performed with the Hartmann procedure and ileostomy. Pathologically, there was no etiology discovered for the necrotizing enterocolitis or stricture.

The infant returned at age six months for an ileostomy take-down and is currently doing extremely well. He is growing appropriately and meeting his developmental milestones during his last check at 9 months of age.

2. Discussion

This is the first report of the potential detrimental effects of e-cigarettes to a fetus via impressive maternal usage. E-cigarettes themselves lack significant research on the effects of long-term inhalation safety in humans. The United States Food and Drug Administration has not reviewed the claims that e-cigarettes...
present a healthy alternative to smoking [1]. The small amount of research that is available on the devices has so far shown poor quality control, misrepresentation and highly variable levels of nicotine delivered, and low levels of toxic contaminants [1,2]. In one study, it was discovered that use of an e-cigarette for only 5 min led to increased lung flow resistance [3]. This change in lung function was suspected to be a result of either high levels of vaporized nicotine or the humectant present in the e-cigarette. In fact, propylene glycol (the most common humectant solution used in e-cigarettes [4]) has been shown to induce respiratory irritation [3]. Noting that use in this case greatly exceeded 5 min per day (as typical usage does), the effect would have been further amplified. Increased lung resistance in the mother would lead to less oxygen reaching the fetus.

In a recent experimental report, maternal nicotine exposure during gestation played a role in hypoxic intestinal injury in rats relevant to human necrotizing enterocolitis [5]. Fetal hypoxia and acidosis were found to be caused by maternal administration of nicotine [5]. During a fetal hypoxic episode, blood is diverted preferentially to the brain and the heart—leaving the skin, intestines, and associated abdominal organs to experience severe ischemia [5]. The amount of nicotine used in this study was 0.25–4 mg/kg body weight per day [5], whereas an e-cigarette cartridges typically contain 20 mg of nicotine [4] and can dispense anywhere from 15 to 45 mg per puff [2]. Thus, assuming an average of ~20 μg per puff, the patient in this report could have received 0.8–1 mg of nicotine per day. On the day of delivery this was increased to about 1–1.4 mg. This is assuming that full dosage of nicotine was not delivered with each puff, but again nicotine levels are highly variable.

Combining the effects of propylene glycol on respiratory function and maternal usage of nicotine on fetal hypoxia creates a very high risk of developing NEC. It may be suggested that since the infant in question was born at full term showing signs of respiratory distress and extensive colonic necrotizing enterocolitis a similar mechanism of fetal hypoxia may have taken place. There is not enough research to warrant the safety of e-cigarette usage during pregnancy, and this may be the first evidence of its adverse effects on the fetus. Until more research is done and more comprehensive regulation is put in place, clinicians should warn expecting mothers of the dangers of e-cigarettes.

References