CORRESPONDENCE

Provider-controlled virtual reality experience may adjust for cognitive load during vascular access in pediatric patients

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To the Editor,

Needle phobia is a prevalent issue in children and can progress to an incapacitating mental illness [Diagnostic and Statistical Manual of Mental Disorders V (B-I-I) type].¹ Patients who suffer from needle phobia tend to avoid invasive medical care, including immunizations and procedures such as vascular access.² We recently had success using a novel non-pharmacological method via a provider-controlled virtual reality (PCVR) headset that displays a customized game. We obtained parental consent to describe the following case in which we utilized this system.

An anxious ten-year-old (83.7 kg; 157 cm; body mass index $34 \text{ kg}\cdot\text{m}^{-2}$) with a history of needle phobia presented for bilateral orchiopexy under planned intravenous induction of anesthesia. Preoperatively, the patient was fitted with a customized Samsung Gear VR headset (Samsung Electronics, Suwon, South Korea) equipped with a Samsung Galaxy S8 smartphone (Figure A). The PCVR was loaded with a game called SpaceburgersTM, developed by the Stanford Childhood Anxiety Reduction through Innovation and Technology (CHARIOT) program specifically for children undergoing minor procedures. With SpaceburgersTM, patients are immersed in outer space and are instructed to “zap” space objects (Figure B). The side button on the VR headset (or hand controller) allows providers to increase temporarily the frequency of objects flying toward the patient (i.e., “turbo mode”). In this case,

the physician triggered the turbo mode just prior to needle puncture, and the nurse was able to place a 22G intravenous (IV) catheter with no interruption or patient discomfort.

We thus used enhanced VR technology to improve the pediatric patient's experience by drawing attention away from the fear and anticipation of needle-induced pain. The patient expressed satisfaction with the experience, saying that this was his least painful encounter with needles and the best experience that he has had at a hospital. The patient's mother also stated that she would recommend VR for other anxious children.

We had attempted a variety of non-pharmacological interventions (e.g., tablet videos, video projection) to alleviate fear associated with IV cannulation in the past – but with limited success. Inhalation mask induction of anesthesia using bedside entertainment and relaxation theatre in conjunction with the previously reported *Sevo the Dragon* program³ was not selected for this patient because of his high body mass index and the increased risk associated with a challenging airway.

Although prior studies⁴ documented no clear evidence to support the use of conventional VR alone as an anxiolytic for vascular access, our case – with equipment designed specifically for the healthcare setting – illustrates its successful application. We believe our PCVR goggles completely blocked the patient's visual field, thereby combating his needle phobia by mitigating the anticipation of pain. Incorporating SpaceburgersTM into the PCVR allows the provider to increase the patient's game-related intensity (cognitive load) temporarily according to the patient's situational needs. Just prior to needle insertion, “turbo mode” offers a simple solution by increasing the distraction level, which may further reduce the patient's fear and perception of pain.⁵ Another

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Figure Provider-controlled virtual reality experience using Spaceburgers™, which was loaded onto the Samsung Gear VR headset. The side button on the VR headset (or hand controller) allows providers temporarily to increase the frequency of objects

flying toward the patient (i.e., “turbo mode”) during vascular access. (A) Patient playing Spaceburgers™. (B) Patient’s view of Spaceburgers™ during the game

advantage of Spaceburgers™ is that it provides the patient an opportunity to participate actively in the gaming experience using only head movement (it does not require limb movement). This is ideal for procedures that require the patient’s limbs to be still, such as gaining IV access and other minor procedures in the extremities.

Although PCVR was effective for this patient, it may not be suitable for all children, particularly those younger or have a history of motion sickness or seizure disorders. The Stanford CHARIOT program seeks to create a library of tools to provide a personalized approach for different age groups and specific patient needs. Further information about Spaceburgers™ can be found on the CHARIOT websites (chariot.stanfordchildrens.org; chariot.stanford.edu).

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Conflicts of interest Spaceburgers is the property of Stanford University.

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