Community Service ISP Report

Title: Case-based learning for high school students: a service-learning activity

Introduction

Doc 4 A Day (D4AD) is a unique elective activity currently offered at the UCSD School of Medicine where medical students get the opportunity to engage with and teach high school students from underserved areas of San Diego. The goals of this activity are two-fold: (1) be a “service-learning” activity for medical students and (2) to encourage and peak the interest of high school students in clinical and biological sciences, who otherwise may never be provided with information about pursuing a career in medicine.

As academic coordinator for D4AD, I worked to expand on the existing D4AD curriculum in an attempt incorporate case-based learning into the four individual workshops that high school students rotate through during their visit to UCSD. I aimed to include a case in each workshop to enhance the student learning by giving a more realistic picture of what it means to be a doctor as well as give the medical students an opportunity to flip roles and extend their own learning to the community. Case-based learning is defined as a “guided inquiry approach”¹ in that the lesson facilitators play an integral role in the problem solving process by helping to point out the key elements of the case. Multiple studies have shown the advantages of this novel teaching style. In a research study looking at teaching techniques for a human bioscience undergraduate course, students who studied the subject with active learning as the major mode of learning outperformed students who were provided a traditional didactic teaching format on the final exam². A recent study on case-based learning for nursing students demonstrated that the case-based learning group showed significantly greater communication skills, problem-solving ability, and learning motivation than the lecture-based learning group³.

I also used this medical student elective to evaluate the benefits of service-learning which is broadly defined as a “carefully monitored service experience in which a student has intentional learning goals and reflects actively on what he or she is learning throughout the experience”⁴.

Methods

Curriculum

High school students were scheduled to rotate through four medical student-run workshops that are structured around the following topics/organ systems: nutrition, neurology, cardiology and gastroenterology. The neurology workshop featured a case of neurocysticercosis complemented by interactive activities focusing on brain anatomy teaching with sheep brain models, lumbar puncture simulations and an introduction to the cranial nerve exam. The gastroenterology workshop featured a case of cholelithiasis complemented by a digestive track and colon anatomy simulation activity, a myth buster trivia game about the digestive system and a laparoscopic surgery and surgical knot tying simulation. The cardiology workshop featured a case of hypertrophic cardiomyopathy complemented by an echocardiogram demonstration, heart anatomy lesson using sheep hearts and an introduction to vital sign measurements. The nutrition
workshop featured a case of diabetes with meal planning and nutrition label instructional activities. The lesson plans and PowerPoint slides are included in the appendix.

The pharmacy students routinely partner with medical students during the D4AD event and hosted a popular hands-on workshop where students learn to compound their own lip balm, interpret prescription labels and count candy to simulate pill counting.

The daylong event also included a panel of doctors with a variety of backgrounds that spoke to their career paths and education and various opportunities to chat with medical students regarding their personal experiences in medical school.

High School Student Survey

At the conclusion of the day, participating high school students were asked to answer a paper based survey. The questions aimed to collect the following information: basic demographics (age, grade and school), prior participation in a previous D4AD event, most preferred and least preferred activities and overall satisfaction with the day.

Participation in D4AD varies from being optional (students electively sign up for the event) to mandatory participation for class credit. As this can be result in a degree of self-selection, we asked students about their interest in a career in health sciences before and after the event on a 5-point scale (1 being “not at all interested” to 5 being “very interested”).

Medical Student Interviews

Seven medical students were interviewed regarding their experience with this service-learning activity immediately after the event. Each student was asked the same group of five questions: 1) How would you rate your level of engagement and interaction with the high school students?; 2) What were your expectations of your role as a case-based facilitator?; 3) Did Doc 4 A Day meet your expectations?; 4) Did Doc 4 A Day make you more aware of the needs of the targeted community?; 5) Did you learn anything new about yourself during this experience?.

This independent study project description was submitted to the UCSD Human Research Protections Program and was deemed to not require IRP approval.

Results

High School Student Survey

After a successful D4AD event on December 6th, 2014, we collected surveys from 68 participating high school students. Based on the survey responses, students from 7 different high schools were represented ranging from 9th to 12th grade (Figures 1 & 2). The male to female ratio was ~1:2 and the mean age was 15.7 ± 1.28 years. Six out of 68 students had participated in a previous D4AD event. When asked about observed differences compared to their prior experience, three noted similar experiences while the others reported it being “a lot smaller and quicker”, “a lot” different and “the cardio class had the ultrasound”.
When asked about their interest in a future career in health sciences, the mean score was $4.2 \pm 1.2$ before D4AD and $4.4 \pm 1.0$ after participation in the event.

When asked about their preferred workshop of the day, the cardiology and pharmacy workshops tied as the most popular with 17.5% of votes (Figure 3). The ultrasound activity itself was also listed independently by 5 students as their favorite part of the day. The least favorite workshop was nutrition with 16.25% of votes (Figure 4). The mean satisfaction of the day on a 5-point scale was $4.75 \pm 0.5$.

Medical Student Interviews

When medical students were asked about their perceived interaction with the high school students and ability to engage them, I received the following answers: “my interaction with the high school students was facilitated by the cases, it was like unraveling a story”; “I don’t interact with teenagers on a regular basis and sometimes find it hard to explain plain facts with the right amount of enthusiasm without making it relevant to the real world, which I used to struggle with myself when I was in high school […] I think having clinical scenarios and using my own personal anecdotal experiences from clinical cases made a big difference in making the cardiovascular system seem relevant to their lives”; “teaching students with a range of interests and of different ages I found to be more difficult than expected”; “I felt comfortable with this PBL format given our own experience in PBL […] it helped me know what information needs to be given and to act as a guide while teaching but not to overpower the teaching experience with too much information and facts”.

When asked if the event had met the medical students’ expectations, one student answered “D4AD mostly met my expectations, however it did surprise me to experience first hand how little information is available to these students about applying to college and medical school”. Another replied “it exceeded my expectations, I had a lot of fun and was genuinely very happy that I participated”. When asked if the event made the medical students more aware of the needs of the community, all answered “yes” and reported “recognizing the need for early intervention in schools to increase awareness about careers in medicine”, the need for more “opportunities for students to get real clinical exposure such as shadowing experiences in order to determine whether a career in medicine is right for them”, and interest in “developing mentoring programs for youth interested in a career in sciences”. When asked what the medical student had learned about themselves during this experience, responses included: “I really enjoyed taking what I have learned and explaining it in a clinically relevant way that these students would understand” and “it was a fun exercise to put myself back in the shoes of these students and attempt to explain concepts to them that were also foreign to me just a few years back, which is something we should also work on in order to explain clinical information to our patients”.

Discussion

Overall, the integration of case-based learning seemed to have a positive effect on the medical student’s experience and improved targeted teaching during the workshops. The interview responses seem to converge toward meeting many of the intended goals of service learning
including an increased social awareness, awareness of their own biases and refinement of communication and teaching. The results of the survey continue to confirm the importance of hands-on activities to engage the high school students during D4AD. For example, the nutrition workshop has historically been more of a lecture based activity without breaking up into smaller groups and requires active participation from the entire group. This unfortunately seemed to be the least popular workshop and would benefit from being modified to break up into smaller groups with more hands-on activities in the future. The introduction of the ultrasound demonstration appears to have been popular, which suggests future interest in other procedural or imaging activities. The information from the survey was passed on to the medical students that took over the organization of D4AD after this December session and will hopefully be carefully integrated to further improve future events.

Figures

Figure 1:

![Participants by high school](image1)

Figure 2:

![Participants by grade](image2)
Figure 3:

![Most preferred activity graph]

Figure 4:

![Least preferred activity graph]

References


**Appendix**

**GI WORKSHOP**

**Case Presentation**

**Part 1**

Miriam Lieberman, a 44-year-old woman, was just admitted to the emergency department for intense pain in her belly. She came in doubled over, gripping her right side, complaining of *really* severe pain and feeling queasy and nauseous even though she has vomited twice in the past hour! She had an “attack” similar to this a few weeks ago after she ate a cheeseburger, animal style fries and a strawberry milkshake from In-n-Out. She thought maybe she had food poisoning or something since she threw up a couple of times but the pain was definitely not as intense as this!

“I feel like someone is stabbing me in here on the right side and its so intense I can feel it in my back and my shoulder!”

**Part 2**

Although she was in really severe pain Miriam was able to give us a little bit more information about her condition. Miriam had been at home when the pain started. It was pretty sudden. She had eaten dinner about 2 hours before the pain started. Recently she has been trying to lose weight and is making herself eat healthy dinners. Chicken and salad. Everyday. But she was still hungry after finishing (“How does lettuce fill anyone up?!”) and ate a piece... well actually more like two pieces... of chocolate cake with ice cream that she had left over from her daughter’s birthday party last week. Soon after finishing her dessert, she had to run to the bathroom. The pain was so bad she called an ambulance to bring her to the emergency room.

**Introductory Activity to the GI System (5 minutes)**

Display blank human body cutout. Place cutout organs (with tape already on back) on desks before kids enter, and the kid who sits there is the volunteer. Each volunteer will have the opportunity to come up together and try to place organ in correct location on body. They can ask rest of class for help. Once they're done, display pre-assembled cutout model with organs in correct location.

Quickly explain the role of each organ using the correct pre-assembled cutout model:

- **Mouth/Oral Cavity**: Chewing (mechanical breakdown) and saliva (chemical breakdown) produced by salivary glands
• **Esophagus**: Stretchy pipe about 10 inches long, muscles squeeze food from throat to stomach, peristalsis (2-3 sec). When you swallow, a flap called the epiglottis covers your windpipe. If you drink something too fast and cough, it might have “gone down the wrong way,” down your windpipe.

• **Stomach**: Stores and breaks down food via muscles in stomach wall and gastric juices. Question: High or low pH? Low pH = acidic. Empties mixture into Small Intestine.

• **Liver and Pancreas**: Bile (helps absorb fats), secrete enzymes important for digestion (help digest fats and protein), Gallbladder stores bile.

• **Small Intestine**: Nutrient absorption (from intestines into blood), 2 inches around, 22 ft long (adult)! Food may spend as long as 4 hours here. (Nutrient absorption not in stomach!)

• **Large Intestine**: Remnants of food that body can’t use go here, 5 feet long, larger diameter than small intestine (3-4 inches around). Water absorption, bacteria help with breakdown, feces formed (last part called the colon). Note Appendix

• **Rectum/Anus**: Where feces stored/come out

### Activities

1. **Station One - Mythbusters Game**

   At this station, you are a group of doctors trying to figure out which of the following statements are myths and which are actually true. We are going to read you a set of statements about the GI system. After each one, you should think about whether you think it is a myth or a fact, and lift up the True or False card as soon as you think you know. We will call on the first person we see raise the card, and then we will discuss the answer. If you yell out an answer, you won’t be called on. We will be handing out prizes to the students who are able to answer questions correctly.

   Cycle through the questions until time is up

<table>
<thead>
<tr>
<th>MYTH OR FACT</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Our feces (poop) is brown in color because when all of the colors or our food mix together it makes brown.</td>
<td>False! Our poop is brown color mostly comes from bilirubin, formed by the breakdown of dead red blood cells, which our bodies try to get rid of as waste. Without bilirubin, our poop would be gray!</td>
</tr>
<tr>
<td>Over 1/3 of the weight of your feces/poop is made up of bacteria.</td>
<td>True! Both dead bacteria from the food we eat and the bacteria that live along our large Intestine contribute greatly to the weight of our poop.</td>
</tr>
<tr>
<td>An adult's stomach can hold this much food (hold up an empty ~1.5 L juice bottle).</td>
<td>True! The adult stomach, on average, can hold up to 1.5 L of food!</td>
</tr>
<tr>
<td>We can make sure that we are eating enough vitamins and nutrients by eating vegetables of all different colors.</td>
<td>True! Simply making sure we eat enough red, green, yellow, purple, or whatever colored vegetables and fruits you see in the supermarket will ensure that you are eating enough vitamins of all kinds.</td>
</tr>
<tr>
<td><strong>Our mouth produces 1 cup of saliva per day.</strong></td>
<td><strong>False! We produce 1-3 pints a day! That’s 2 – 6 cups!!!</strong></td>
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<tr>
<td><strong>The reason that the GI track has such a smooth surface is so that what we eat do not get obstructed while being digested.</strong></td>
<td><strong>False! Trick question because the GI track might sometimes seem smooth, but the small intestine is actually composed of many miniature folds to increase the contact area that it has with food. The GI track is smooth because we secrete a huge amount of mucus (from Goblet cells) to make sure that food doesn’t stick.</strong></td>
</tr>
<tr>
<td><strong>It takes about 1 hour to digest a meal.</strong></td>
<td><strong>False! It takes your stomach 2-6 hours to empty, and additional time is needed to absorb all the nutrients in the intestines.</strong></td>
</tr>
<tr>
<td><strong>Eating beans can give you gas (flatulence).</strong></td>
<td><strong>True! Beans contain a sugar that the human body cannot break down, so they are broken down in large intestine by bacteria that generate gas.</strong></td>
</tr>
<tr>
<td><strong>If you wait at least 30 minutes after eating a meal before exercising, you can prevent yourself from getting appendicitis.</strong></td>
<td><strong>False! While there is a small (but unproven) chance that exercise after eating can lead to an obstruction of your appendix which can lead to appendicitis, it is largely unknown why you get the disease. It has been speculated however that other major causes are due to small hardened stool getting stuck in the appendix due to poor diet practices, bacterial or viral infection in the appendix, genetics, inflammation of other organs squeezing the appendix, or injury.</strong></td>
</tr>
</tbody>
</table>
| **Eating foods rich in fiber will lower our cholesterol levels.** | **True! Our body has to secrete some cholesterol in the form of bile salts in order to absorb fats. If we eat lots of fiber, then the fiber will bind onto these cholesterol and leave the body when we go to the restroom.**
**BONUS question: Which foods are rich in fiber?**
Fruits (prunes, pear, berries...), whole wheat breads, nuts & seeds, legumes (beans, lentils, split peas,...) |
<p>| <strong>Wheat and rye are good for everyone.</strong> | <strong>False! Celiac Disease (or gluten allergy) is a common condition in which people are allergic to a protein found in wheat, rye, and barley. Patients with Celiac Disease must avoid these items and buy gluten-free products in order to prevent themselves from having digestive problems and experiencing nausea, vomiting, and diarrhea.</strong> |
| <strong>GI problems can affect your skin.</strong> | <strong>True! Certain conditions, particularly those involving the liver, can turn your skin yellow. And other conditions can affect your skin as well. For example, a type of liver disease called Non-Alcoholic Steatohepatitis may cause hyperpigmentation in the skin of some patients. Additionally, certain foods can cause people to break out in hives if they are allergic.</strong> |</p>
<table>
<thead>
<tr>
<th>Statement</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most people have food allergies.</td>
<td>False! Only 4-5% of the population has an allergy to a specific food. However, 20-30% of people think they have a food allergy.</td>
</tr>
<tr>
<td>Your small intestine is as long as you are tall.</td>
<td>False! The small intestine is around 20 feet long!!!</td>
</tr>
<tr>
<td>Digestion takes place primarily in the stomach.</td>
<td>False! The major part of the digestive process takes place in the small intestine. The stomach takes in the food, then churns it and breaks it into tiny particles called “chyme”. The chyme is then released in small batches into the small intestine, where most digestion occurs and nutrients are absorbed.</td>
</tr>
<tr>
<td>If you cut down on your food intake, you'll eventually shrink your stomach so you won't be as hungry.</td>
<td>False! Once you are an adult, your stomach pretty much remains the same size unless you have surgery to intentionally make it smaller. Eating less won't shrink your stomach but it can help to reset your &quot;appetite thermostat&quot; so you won't feel as hungry, and it may be easier to stick with your eating plan.</td>
</tr>
<tr>
<td>Thin people have naturally smaller stomachs than people who are heavy.</td>
<td>False! While it may seem hard to believe, the size of the stomach does not correlate to weight or weight control. People who are naturally thin can have the same size or even larger stomachs than people who battle with their weight throughout a lifetime.</td>
</tr>
<tr>
<td>Exercises like sit-ups or abdominal crunches can reduce the size of your belly.</td>
<td>False! Exercise cannot reduce one area of fat selectively, but it can help to burn off all the fat that's accumulated both outside and inside your body. It can also help tighten the muscles in the abdomen, and that will help to give you a leaner, trimmer look.</td>
</tr>
<tr>
<td>A 200-calorie snack of peanut butter and crackers is more likely to control your appetite than just eating 200 calories' worth of crackers.</td>
<td>True! The reason: &quot;Fats digest much slower than carbohydrates, and they remain in the stomach longer, which means we naturally feel full longer after eating a snack that contains at least some fat&quot;. Carbohydrates (like crackers, bread, or biscuits) elicit a quick increase in blood sugar and insulin levels, which subsequently drop just as quickly, causing dramatic shifts in both mood and appetite.</td>
</tr>
<tr>
<td>Your mouth is part of your GI system and it is where digestion begins.</td>
<td>True! Digestion begins in the mouth when enzymes start breaking down the food into smaller pieces so by the time the food gets to the intestines where it is absorbed it is almost broken down to its smallest form.</td>
</tr>
<tr>
<td>Having 1 bowel movement a week can be considered normal.</td>
<td>True! The number of bowel movements a person has per week is variable and depends on how much you eat and what you eat. Individuals with high fiber diets tend to go more often while</td>
</tr>
<tr>
<td>False! Our bodies are composed of millions of bacteria, many of which are important for our overall health. While many bacteria will make you sick you need a lot of the bacteria to help break down some of the foods you eat like certain vegetables and foods rich in fiber.</td>
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<td>All bacteria/germs will make you sick and cause an upset stomach.</td>
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<td>False! The trachea is what connects your lungs to the outside world and where air enters. Food should NEVER go down the trachea because it could cause choking and infection. The esophagus, which is behind the trachea, is a part of the GI tract and is the passage where food goes from the mouth to the stomach.</td>
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<td>False! Your esophagus pushes the ball of food you have chewed up down to your stomach through a mechanism called peristalsis. This involves alternate contraction and relaxation of the muscles in your esophagus, so the food can be squeezed downward, kind of like ocean waves traveling toward your stomach.</td>
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<td>True! Our mouth is part of our digestive system, and this includes teeth, which are made of bone. Teeth are a necessary part of the digestive system, allowing us to tear and grind our food into smaller pieces so that it can be swallowed.</td>
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<td>True! The first phase of digestion is called the cephalic phase. When you see, smell, or even just think about the food you are about to eat, your stomach begins to release the enzymes needed for digestion.</td>
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<td>False! The body needs certain nutrients from food, and these are absorbed from the gut (mostly in the small intestine) into the blood and delivered to different organs and tissues. The body also obtains and stores sources of energy such as carbohydrates and fat.</td>
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<td>False! Though this is true most of the time, the sphincter must occasionally open to allow for certain functions such as vomiting or burping.</td>
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**Table:**

<table>
<thead>
<tr>
<th>True!</th>
<th>False!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Those with diets rich in meat go less often. A normal amount of bowel movements can be anywhere from 3/day to 1/week.</td>
<td>All bacteria/germs will make you sick and cause an upset stomach.</td>
</tr>
<tr>
<td>The trachea/windpipe is an organ that is part of the GI tract.</td>
<td>Food gets down to your stomach by falling (using gravity).</td>
</tr>
<tr>
<td>There are bones in our digestive system.</td>
<td>The digestive process starts before you even put food in your mouth.</td>
</tr>
<tr>
<td>Everything you eat is excreted in either your feces (poop) or urine (pee).</td>
<td>The sphincter between your esophagus and your stomach must always stay closed between meals to prevent food from coming up.</td>
</tr>
</tbody>
</table>
Fats can be good for you.

True! We all need a certain amount of fat in our diets in order to store energy. Additionally, fats help absorb certain vitamins such as Vitamin A and E into the blood to be delivered to different parts of the body. Fat also helps provide insulation and cushioning throughout the body. However, fats should be avoided in excess, and items with trans fats or saturated fats should also be avoided. “Healthy” fats can be obtained from foods such as fish, nuts, and avocados.

The liver is the largest internal organ and the largest gland in the body.

True! The liver is the largest solid organ in the body (your skin is actually the largest organ overall!), and the heaviest, weighing about 3 lbs or more.

The gallbladder can change from the size of the size of a small pear to completely flat within 1 hour.

True! Before a meal the gallbladder is filled with bile to the size of a small pear. Then during a meal the gallbladder reacts to signals squeezing the bile into the small intestine by way of the “ducts”. The bile’s function is to aid in the digestion of fats. After the meal, the gallbladder is empty and becomes flat.

II. Station Two - Laparoscopic Surgery and Knot Tying

Welcome to the Operating Room! We’re going to do 2 activities here: practice a surgical procedure and learn how to tie surgical knots!

You are a new doctor and you see your first patient of the day. She has appendicitis.

Does anyone know what that is? What causes it? How do you treat it?
  • The appendix is a fingerlike pouch that sticks out from your large intestine.
  • It has no known functional role in humans.
  • Inflammation of the appendix can be caused by bacterial infection, blockage by food, stool, or tumor.

How many people get appendicitis? 1/15 people

Our patient needs an appendectomy.

What is that? Do you know anyone who has had one? How are appendectomies preformed nowadays?
  • Laparoscopic surgery is used for operations in the abdomen. These are performed through small incisions (cuts) for example, in the belly button. A small camera is inserted through one hole so the surgeon can see what he is doing inside the body on a screen in the operating room.
  • Benefits: patients have less pain afterward, lower chance of bleeding, will recover faster, no scar

We are going to perform a laparoscopic surgery to remove her inflamed appendix!
Two students will go to the laparoscopic surgery station for 2 minutes max while the other students work on the surgical knot tying.

Laparoscopic Appendectomy
Goal: Use the chopsticks to remove the inflamed appendix (PlayDoh ball) and put it into the cup.
Rules: you can only look at the computer screen, not into the body
Only 40 seconds per student. Goes by really fast! Time them.

Surgical knot tying - http://m.youtube.com/watch?v=-smZKFnC-U8

III. Station Three - Making poop!

Source: http://teachers.net/lessons/posts/1303.html

This activity is intended to review the path and breakdown of food during digestion. After taking part in this activity participants should be able to state the order of organs in the gastro-intestinal system and have a basic understanding of food breakdown and movement in the GI system.

1. Simulate chewing by crushing 2 Oreos and half a banana in ziplock bag. (may want to double ziplock bag!)
   i. What kind of breakdown are we simulating? Mechanical breakdown!
2. Simulate saliva by adding a small amount of water (very small!)
   i. What does the water represent and what function is it performing? Saliva, chemical breakdown!
3. Show students the peristalsis motion of the esophagus by wadding up a newspaper ball as the bolus of food, and moving it through one leg of a nylon stocking.
   i. What is this motion called? Peristalsis.
4. Now the food in the ziplock bag is in the "stomach". Ask students to further churn the contents of bag to simulate motion of stomach. Add a very small amount of soapy water to simulate "acid" in the stomach.
   i. What does the stomach acid do? Help break down food and kill pathogens.
5. Cut hole in corner of bag, squeeze food into open end of stocking (other side of stocking should be closed, may want to place stocking temporarily in a cup and stretch it over the outside edge of cup to make it easier). The stocking simulates the SI.
   i. Who can name the 3 parts of the small intestines? Duodenum, jejunum, and the ileum.
6. Squeeze in some green soap – this is bile from the gallbladder and pancreatic juices from the pancreas.
   i. What do these do? Bile helps us absorb fats and pancreatic juices are full of enzymes that allow us to break down, or digest carbs, proteins and fats.
7. Put on gloves and have a volunteer put on gloves as well. Lift up stocking with food inside, and ask volunteer to squeeze food through stocking to other end.
   i. What does the water coming out represent? Water coming out simulates nutrients going to the rest of the body, once they have been completely broken down, or digested, by the pancreatic juices.
8. When the food reaches the closed end of stocking, cut a hole and squeeze food into paper cup.
   i. What is the paper cup simulating? The large intestines.
   ii. Can anyone name the parts of the large intestines? Cecum, ascending, transverse, descending, and sigmoid colon.
9. With a pencil, poke a hole in the bottom of the cup. Take another paper cup, and press down on the food inside of the cup, so food comes of the hole in the first cup (into another cup or a tray on the table). This simulates unused food exiting the body!
   i. What are the final parts of the digestive tract? Rectum and anus.

Case conclusion

Talking points:

- What organs lie on the right side that could be causing Miriam this pain?
  DDX of RUQ pain:
  - Liver disease: hepatitis, tumor
  - Gallbladder disease: cholecystitis (acute/chronic), cancer
  - Stomach: PUD
  - Pancreas: pancreatitis
  - Bowel: obstruction, cancer, atypical acute appendicitis, IBD, IBS
  - Renal disease: pyelonephritis
  - CV: MI, atypical angina
  - Pulm: pneumonia

Part 3

You have a pretty good idea what is going on. Just to be sure, you send Miriam to get a quick ultrasound of her abdomen.

Show ultrasound image

- What do you see? What organ do you think this is?
- This is the gallbladder – does anyone remember what the gallbladder does?

Part 4

You tell Miriam that she has cholecystitis – or an inflamed gallbladder! You explain that the most common cause of gallbladder inflammation is gallstones, which were seen on her ultrasound. These are stones that develop in the gallbladder and if they get too big they can block the little tube that allows bile to leave the gallbladder. When the bile isn’t allowed to exit it builds up in the gallbladder and results in inflammation.

Part 5

The best treatment option for cholecystitis is surgery to remove the gallbladder. Even though this “attack” may go away like the last one did, she will probably have another one soon, and they usually occur after big or fatty meals. She agrees to the surgery – especially when she hears that it can be done laparoscopically so there won’t even be a big scar left after the surgery and she can live just fine without a gallbladder. However, you still encourage Miriam to keep eating health! As you all learned, your body needs fats, but fats in excess can cause health problems and should be avoided!
In the emergency department...

Miriam Lieberman, a 44-year-old woman, was just admitted to the emergency department for intense pain in her belly. She came in doubled over, gripping her right side, complaining of really severe pain and feeling queasy and nauseous and she has vomited twice in the past hour!
In the emergency department...

+ She had an “attack” similar to this a few weeks ago after she ate a cheeseburger, animal style fries and a strawberry milk shake from In n Out. She thought maybe she had food poisoning or something since she threw up a couple of times but the pain was definitely not as intense as this!

+ “I feel like someone is stabbing me in here on the right side and its so intense I can feel it in my back and my shoulder!”

A little more history...

+ Although she was in really severe pain Miriam was able to give us a little bit more information about her condition.

+ She had been at home when the pain started. It was pretty sudden. She had eaten dinner about 2 hours before the pain started. Recently she has been trying to lose weight and is making herself eat healthy dinners. Chicken and salad. Everyday. But she was still hungry after finishing (“How does lettuce fill anyone up?!”) and ate a piece... well actually more like two pieces... of chocolate cake with ice cream that she had left over from her daughter’s birthday party last week. Soon after finishing her dessert, she had to run to the bathroom. The pain was so bad she called an ambulance to bring her to the emergency room.
On examination

- Temperature: 101.3 °F
- Pulse: 103 beats/min
- Respiratory rate: 28 breaths/min
- Blood pressure: 110/71
- Abdomen is tender to palpation in the right upper quadrant

You reassure her that you are going to do your best to get to the bottom of this.
Activities

Recap
What do we know about Miriam so far?
What organs lie on the right side of the body that could be causing Miriam this pain?
You have a pretty good idea what is going on. Just to be sure, you send Miriam to get a quick ultrasound of her abdomen.
You tell Miriam that she has **acute cholecystitis** (an inflamed gallbladder) due to a big gallstone.

**Treatment**

- You explain that the best treatment option for cholecystitis is surgery to remove the gallbladder.

- Even though this current “attack” may go away like the last one did, she will probably have another one soon, and they usually occur after big or fatty meals.
Miriam agrees to the surgery – especially when she hears that it can be done laparoscopically so there won’t even be a big scar left after the surgery and she can live just fine without a gallbladder.

However you still encourage her to keep eating healthy! As you all learned, your body needs fats, but fats in excess can cause health problems and should be avoided!

Any Questions?
Thank you!
Eddie Johnson is a 15-year-old boy who is in clinic today to get a sports physical for school. You walk in to the exam room and see a tall boy sitting on the exam table, accompanied by his mom who was sitting nearby in a chair.

Two medical students or 1 medical student and 1 high school student volunteer “role play”

“Hi Eddie! I am Dr. Hart. How are you today?”
“Good thank you.”
“What brings you in today?”
“Just here to get cleared for sports at school.”
“Oh great – what sports are you playing?”
“I recently started on the baseball team.”
“What position do you play?”
“Outfield usually and I’m really good at hitting home runs!”
“That’s very good to hear! How has practice been so far?”
“It’s going pretty well... Definitely keeps me active. I go to practice in the morning then class and then a couple more hours of practice in the afternoon then I go home and do homework. I’m really trying to get into UCSD and hope that I can get some sort of sports scholarship with this.”
“Woah – definitely sounds like a busy time, but glad to hear that you’re staying on top of your work too. Have you noticed any symptoms while you exercise? Feeling like you are light headed, dizzy or about to pass out? Your heart beating faster than normal or skipping a beat at times? Any difficulty breathing?”
“Hmm… well sometimes I feel really out of breath when I’m exercising... but no haven’t felt anything else. That’s normal though right?”

Eddie’s mom tells you that he has been pretty healthy all of his life and never had any childhood illnesses and is not on any medications. The only time he had to go to the hospital was to get stitches after he had a little accident and fell off of his bike. Everyone on his dad’s side of the family is healthy but she has high blood pressure, which she takes medications for. It is really important for her to control her blood pressure because her brother recently passed away from a heart attack and her father also passed away from a heart attack when she was really young.

Once you have taken all of the history you think is relevant, you ask Eddie if he is ready to start the physical exam.

Activities

I. Station One - Vital signs, Cardiac & Lung exam

Objective: By the end of their participation at this station, students should be able to:
1. Name the four vital signs
2. Estimate the normal ranges for each of the four vital signs
3. Describe how to measure each of the four vital signs
4. Measure the pulse
5. Predict how the pulse might change under varying conditions

Vital signs introduction (3 minutes)

1. Introduce to the students to the four vital signs (temperature, pulse rate, blood pressure, respiratory rate) by asking students what they think they are prior to introducing the material.
2. Introduce the normal values by soliciting student pre-knowledge. Explain what abnormal values might indicate about a patient.
3. Introduce methods for measuring each of these vital signs again by soliciting student pre-knowledge. Perhaps use a student to demonstrate how the signs are taken.

Pulse activity (3 minutes)

1. Explanation of pulse. Pulses are caused by your heart contracting; when your heart is pumping blood out into the body, a wave of blood comes out of the heart and that’s what you feel when you are taking your pulse. Pulses can tell you about a person's heart rate
2. Explanation of factors that affect pulse. Stress, exercise,
3. Have students take pulse of a partner
4. Exercise for 1 min - jumping jacks and whatever other physical activity
5. Take pulse after and ask them if they understand why it went up

Cardio exam & stethoscope activity (6 minutes)

1. Brief introduction of the cardio exam (auscultation part) and a brief description of the heart valves and normal heart sounds (S1, S2)
2. Demonstrate proper listening technique with stethoscope
3. Allow students to auscultate with a partner to assess heart sounds
4. If time permits, allow students to listen for lung sounds as well

II. Station Two - Cardio (and Pulmonary) Anatomy

Objective: By the end of their participation at this station, students should be able to:
1. Describe the basic anatomy and blood flow of the heart (four chambers, four valves, oxygenated/deoxygenated blood flow, aorta/VC)
2. Understand briefly that the heart walls are muscular and the electrical activity that makes the heart pump
3. If time permits, describe the basic anatomy of the lungs (trachea, bronchi, alveoli)

Cardio Anatomy: Use pre-made posters and models to show four chambers, four valves, and major vessels of the heart. Students can then look at heart specimens.
The heart is located under the rib cage, slightly to the left of the sternum and between the lungs. It is an organ made of muscle. The strong muscular walls contract, pumping blood to the rest of the body. (How does the heart’s muscle get blood? The coronary arteries, on the surface of the heart, supply oxygen-rich blood to the heart muscle itself. Coronary = crown) The major blood vessels that enter the heart are
the superior vena cava, the inferior vena cava, and the pulmonary veins. The pulmonary artery and the aorta exit the heart and carry oxygen-rich blood to the rest of the body. The heart has four chambers. It is divided into the left and right side by a muscular wall called the septum. The right and left sides of the heart are further divided into two top chambers called the atria, which receive blood from the veins, and two bottom chambers called ventricles, which pump blood into the arteries. The atria and ventricles work together, contracting and relaxing to pump blood out of the heart. As blood leaves each chamber of the heart, it passes through a valve. The heart valves work the same way as one-way valves in the plumbing of your home. They prevent blood from flowing in the wrong direction. There are four heart valves within the heart are:

- Mitral valve
- Tricuspid valve
- Aortic valve
- Pulmonic valve

Blood flow, R side:
- Blood enters the heart through the inferior and superior vena cava, emptying oxygen-poor blood from the body into the right atrium of the heart.
- As the atrium contracts, blood flows from your right atrium into your right ventricle through the open tricuspid valve.
- When the ventricle is full, the tricuspid valve shuts. This prevents blood from flowing backward into the atria while the ventricle contracts.
- As the ventricle contracts, blood leaves the heart through the pulmonic valve, into the pulmonary artery and to the lungs, where it is oxygenated and then returns to the left atrium through the pulmonary veins.

Blood flow, L side:
- The pulmonary veins empty oxygen-rich blood from the lungs into the left atrium of the heart.
- As the atrium contracts, blood flows from your left atrium into your left ventricle through the open mitral valve.
- When the ventricle is full, the mitral valve shuts. This prevents blood from flowing backward into the atrium while the ventricle contracts.
- As the ventricle contracts, blood leaves the heart through the aortic valve, into the aorta and to the body.

How does the heart beat?

Your heartbeat is triggered by electrical impulses that travel down a special pathway through the heart. The impulse starts in a small bundle of specialized cells called the SA node in the right atrium. This node is known as the heart's natural pacemaker. The electrical activity spreads through the walls of the atria and causes them to contract. A cluster of cells in the center of the heart between the atria and ventricles, the AV node is like a gate that slows the electrical signal before it enters the ventricles. This delay gives the atria time to contract before the ventricles do. The His-Purkinje network is a pathway of fibers that sends the impulse to the muscular walls of the ventricles, causing them to contract.

At rest, a normal heart beats around 50 to 99 times a minute. Exercise, emotions, fever, and some medications can cause your heart to beat faster, sometimes to well over 100 beats per minute.

Pulm Anatomy: Use pre-made posters and models to show branching of trachea to bronchi, alveoli.

**III. Station Three – Ultrasound activity**
One medical student will volunteer as model and other facilitator will demonstrate cardiac windows.

a. **Long Axis Parasternal** – sweep probe across the parasternal area in the 3rd or 4th intercostal space. Look for/point out the **mitral valve**.

![Diagram of Long Parasternal View](image1.png)

b. **Short Axis Parasternal** – turn probe 90 degrees, point toward the left shoulder. You will see a circular view of the left ventricle. At the level of the mitral valve you are at the base, at the level of the papillary muscles you are at the mid-section and the smallest diameter is at the apex.

![Image of Short Parasternal View](image2.png)

c. **Subxiphoid** – angle probe up into the chest, can point out transition from IVC to the right atrium.

![Image of Subxiphoid View](image3.png)

d. **Apical** – place probe at PMI/lateral to the nipple line. Can point out the four chambers, ventricular septum and valves.

![Image of Apical View](image4.png)
Case conclusion

Part 3

Eddie’s physical exam was normal. However, slightly concerned about the history of heart disease on his mom’s side, Dr. Hart decides to order an echocardiogram, or an ultrasound of his heart.

- What could the ultrasound show you about his heart?

Part 4

Show U/S image and drawing of hypertrophic cardiomyopathy

The ultrasound reveals that Eddie’s heart muscle is abnormally large, particularly around his left ventricle.

- How might a larger left ventricular wall be a problem?

You will have to do other tests to confirm but you tell Eddie and his mother that it is very likely that he has hypertrophic cardiomyopathy.

Discuss what this is, epidemiology, genetic inheritance and treatment

This condition affects about one in 500 people. It is sometimes present at birth and can develop in young children. However, it most commonly develops in early adulthood. Most people with this condition do not actually have any symptoms. Possible symptoms that may develop however are:

- Shortness of breath: this may develop with exercise if the condition is mild. If the condition is more severe, SOB can occur at rest
- Chest pain (angina): can also occur with exercise, but when more severe can also occur at rest. The pain occurs because the supply of blood and oxygen to the heart muscle is not sufficient to meet the demands of the thickened muscle.
- Palpitations: sometimes abnormalities of heart rhythm (arrhythmias) develop which can cause palpitations. Patients may become aware that your heartbeat is fast and/or irregular.
- Dizziness and fainting attacks: These occur more commonly with exercise, but may occur at rest. This may be due to reduced output of blood from the heart or because of arrhythmias.”
Today in clinic…

• Eddie Johnson is a 15-year-old boy who is in clinic today to get a sports physical for school.

• You walk in to the exam room and see a tall boy sitting on the exam table, accompanied by his mom.
Eddie’s story

D - “Hi Eddie! I am Dr. Hart. How are you today?”
E - “Good thank you.”
D - “What brings you in today?”
E - “Just here to get cleared for sports at school.”
D - “Oh great – what sports are you playing?”
E - “I recently started on the baseball team.”

Eddie’s story

D - “What position do you play?”
E - “Outfield usually and I’m really good at hitting home runs!”
D - “That’s very good to hear! How has practice been so far?”
E - “It’s going pretty well... Definitely keeps me active. I go to practice in the morning then class and then a couple more hours of practice in the afternoon then I go home and do homework. I’m really trying to get into UCSD and hope that I can get some sort of sports scholarship with this.”
Eddie’s story

D - “Wow – definitely sounds like a busy time, but glad to hear that you’re staying on top of your school work too! Now let’s talk a little bit more about practice. Have you noticed anything unusual while you exercise? Feeling like you are light headed, dizzy or about to pass out? Feel your heart beating faster than normal or skipping a beat at times? Any difficulty breathing?”

E - “Hmm… well lately I have felt really out of breath when practice starts… but no… that’s about it.

A little more history…

• Eddie’s mom tells you that he has been pretty healthy all of his life and never had any childhood illnesses and is not on any medications. The only time he had to go to the hospital was to get stitches after he had a little accident and fell off of his bike.

• When asked about his family history she tells you that everyone on his dad’s side of the family is healthy but she has high blood pressure, which she takes medications for. It is really important for her to control her blood pressure because her brother recently passed away from a heart attack and her father also passed away from a heart attack when she was really young.
On to the physical exam…

• Once you have taken all of the history you think is relevant, you ask Eddie if he is ready to start the physical exam!
What do we know about Eddie so far?

Physical exam findings

- On Eddie’s physical exam you record a normal heart rate and blood pressure. The lung, abdominal and head and neck exams were all normal. You also recorded normal strength and flexibility in all limbs and normal joints.

- However, when listening to the heart you hear a faintly abnormal sound.
Electrocardiogram

Slightly concerned about the abnormal heart sound and the history of heart disease on his mom's side, you decide to order an echocardiogram, or an ultrasound, of Eddie's heart.

Echocardiogram Recording

The ultrasound reveals that Eddie's heart muscle is abnormally large, particularly around his left ventricle.
HYPERTROPHIC CARDIOMYOPATHY

- You will have to do other tests to confirm but you tell Eddie and his mom that it is very likely that he has hypertrophic cardiomyopathy.

- Heart disease that causes thickening of the heart muscle

- Difficult for left ventricle to fill with blood and therefore pump enough blood to the body → shortness of breath!

- Mitral valve function is also disrupted due to the narrowing of the left ventricle → abnormal heart sound!

GENETIC INHERITANCE!

- Most common genetic heart disease
- Affects 1/500 in adult population
- Due to a genetic mutation that affects the heart muscle cells

- In young adults, hypertrophic cardiomyopathy is the most common cause of sudden cardiac death!
TREATMENT

• Lifestyle modifications – unfortunately Eddie will need to refrain from strenuous physical activity for the time being which won't be an easy conversation to have

• Reduce the strain on the heart by using medications that slow the heart beat and force of contraction

• Open heart surgery to clear some of the enlarged portions of the heart muscle

• Heart transplant in severe cases

• Genetic testing for his relatives!

ANY QUESTIONS?
Thank you!
**NEURO WORKSHOP**

**Case Presentation**

**Part 1**

Jessica Gonzalez, a 29 year old female, was just admitted in the emergency department with her husband Ruben. Her husband tells you that they were at home cooking dinner when all of a sudden Jessica was on the ground with her body really stiff. Alarm,ed, he called out her name but she wasn’t responding. She seemed to let out a big puff of air and then all of a sudden her legs and arms started shaking uncontrollably. It all lasted 1-2 minutes although he was so worried “it seemed like forever”. When the shaking stopped her body seemed to relax and she regained consciousness but didn’t seem to realize what had happened and had a horrible headache. As soon as Ruben realized that he could get her up, he took her right to the car and drove her straight to the hospital!

**Part 2**

Jessica tells you that she’s been pretty healthy all of her life. She has never had anything like this happen to her before and has never heard of a seizure disorder or any other form of brain disease in her parents or 5 brothers or sisters. Ruben and Jessica were married a couple months ago in a huge wedding in Jessica’s hometown of Guadalajara with all of their very large extended family and friends. Jessica was born in Guadalajara and lived there until she was 18 when she came to San Diego for college at UCSD. While it was an amazing time in their lives, they both expressed feeling like they could use another honeymoon after all of the work they put into organizing the wedding and of course the fun yet busy time they had back home! And now this??!

“What is wrong with me doctor? Am I going to be ok?” Jessica asked.

You reassure her that you are going to do your best to get to the bottom of this. You call over your very competent medical student, Brian, to do a full physical exam and work up.

**Activities**

1. **Station One - Cranial Nerve Exam**

Nerves carry information between our brain and the rest of our body. When you sense something, that information is carried in towards the brain, while our brain also sends information out to our body to make it act or move. Since the brain is far from most of your body, most of your nerves actually travel up and down your spinal cord to allow your body to communicate with your brain. However, there are 13 special nerves that come directly off of your brain to communicate with a particular body part. These are called your **cranial nerves**. What area of the body do you guys think these nerves go to and from? (The head – because it’s close to the brain)

Today, you will learn the exam that doctors perform to make sure that these special cranial nerves are functioning properly.

**CN I – Olfactory**

1. Test each nostril with scented soap

**CN II – Optic Nerve**

Acuity – how good your eye sight is
1. Use eye chart from 20 ft away for each eye
2. Determine if they have 20/20 vision (ex. 20/40 vision = what you can see from 20 ft, a person with normal vision can see from 40 ft)

Visual fields – peripheral vision
1. Cover one eye
2. Examiner wiggles finger in 4 quadrants of periphery

Pupillary light reflex – pupil should constrict when you shine a light on it
1. Cover eyes for a few seconds so that it thinks it is “dark”
2. Uncover and shine light into one eye
3. Pupils in BOTH eyes should constrict

CN III, IV, VI – Oculomotor, Trochlear, Abducens
Eye movements
1. Stand 1 meter apart
2. Examiner draw a big H and the examinee should follow with eyes only (do not move head)
3. Move finger towards examinee’s nose and the eyes should converge (cross-eyes)

CN V – Trigeminal
Light touch
1. Touch forehead, cheeks, chin w/ cotton or tissue

CN VII – Facial
Controls the muscles for facial expression
1. Raise eyebrows
2. Smile showing teeth
3. Frown
4. Puff out both cheeks
5. Close eyes tightly

CN VIII – Vestibulocochlear
Hearing
1. Close eyes
2. Rub fingers next to ear and ask which side they hear the noise

CN IX, X – Glossopharyngeal, vagus
Goes mostly to the back of your mouth for taste, swallowing, talking
1. Stick out tongue and say “Ahhh”
2. Observe to see if palate raises symmetrically

CN XI – Accessory
Trapezius and Sternocleidomastoid muscle
1. Shrug shoulders up against examiner pushing down
2. Turn head against examiners hand to each side

CN XII – Hypoglossal
Tongue movement
1. Stick out tongue
2. Move left, right, back to center

If time permits, you can also go over some major reflexes tested during the Neuro exam.

II. Station Two – Learning brain lobes with sheep brains & plastic brain models

Objective: By the end of their participation at this station, students will know:

1. The basic functions of the cerebrum, cerebellum, diencephalon, and brain stem (midbrain, pons, and medulla oblongata)
2. The locations of the four lobes of the cerebrum (frontal, parietal, occipital, and temporal) on a sheep brain.
3. The locations of the listed organs other than the cerebrum on a plastic brain model.
4. Understand the basics of what happens during a seizure.

III. Station Three – CSF & Lumbar Puncture

Cerebrospinal fluid (CSF) is a clear, colorless liquid that surrounds the brain and the spinal cord. Its main function is to cushion the brain within the skull and serve as a shock absorber for the central nervous system. It also contains and circulates a lot of important nutrients for the brain from the blood.

CSF as a shock absorber

1. Place an egg in an empty plastic water bottle.
2. Place another egg in a plastic water bottle and fill the water to the very top with water.
3. Ask the students what they think will happen to the eggs if you were to shake the two bottles.
4. Shake the bottles, observe that only the egg in the empty water bottle cracks, and explain the relationship of the water to the CSF.

Examining the CSF can be useful in diagnosing many diseases of the nervous system. CSF is obtained by doing a lumbar puncture or “spinal tap”. This is done with the patient lying on his or her side. After cleansing and injecting an anesthetic into the area, a long, thin, hollow needle is inserted between two bones in the lower spine and into the space where the CSF circulates. One to two tablespoons of the fluid are withdrawn through the syringe.

LP simulation

<table>
<thead>
<tr>
<th>Normal values</th>
<th>Discuss with the students what the normal results are, why these substances are found in the CSF and what an abnormal appearance or value may indicate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pressure: 70 - 180 mm H2O</td>
<td></td>
</tr>
<tr>
<td>• Appearance: clear, colorless</td>
<td></td>
</tr>
<tr>
<td>• CSF total protein: 15-60 mg/100 mL</td>
<td></td>
</tr>
<tr>
<td>• CSF glucose: 50-80 mg/100 mL</td>
<td></td>
</tr>
<tr>
<td>• White blood cells: 0-5</td>
<td></td>
</tr>
<tr>
<td>• Red blood cells: none!</td>
<td></td>
</tr>
</tbody>
</table>
What do abnormal results mean?

Appearance:
- If the CSF looks cloudy, it could mean there is an infection or a build up of white blood cells or protein.
- If the CSF looks bloody or red, it may be a sign of bleeding or spinal cord obstruction.
- If it is brown, orange, or yellow, it may be a sign of increased CSF protein or previous bleeding (more than 3 days ago). Occasionally, there may be blood in the sample that came from the spinal tap itself. This makes it harder to interpret the test results.

Pressure: increased CSF pressure may be due to increased pressure inside the skull – this is bad because it could be compressing the brain!

CSF protein: increased CSF protein may be due to blood in the CSF, diabetes, a tumor, or an inflammation.

CSF glucose:
- Increased CSF glucose is a sign of high blood sugar
- Decreased CSF glucose may be due to low blood sugar, a bacterial or fungal infection (such as meningitis or tuberculosis)

Blood cells in the CSF:
- Increased white blood cells in the CSF may be a sign of meningitis, acute infection, beginning of a chronic illness, tumor...
- Red blood cells in the CSF sample may be a sign of bleeding into the spinal fluid or the result of a traumatic lumbar puncture
Case conclusion

Talking points:

• Review what can cause a seizure. What is our differential diagnosis?
  o Can involve some injury to the brain – head injuries, brain tumors, lack of oxygen, infections in the brain, abnormal levels of substances such as too much salt or too little blood sugar
  o However, many times no cause is discovered!

• What tests we should run?
  o Physical exam – check cranial nerves
  o Lumbar puncture – possible infection?
  o Neuroimaging, CT or MRI

Part 3

Brian immediately scheduled a lumbar puncture and MRI scan for Jessica. In the meantime, as he waits for her scan, he did a full cranial nerve exam on Jessica and found that ____ (will depend on MRI lesions). Hmm...

When the MRI was done, the technician paged you and Brian right away and said “You’re going to want to take a look at this”.

Show MRI scan

Part 4

What is neurocysticercosis?

• Most common cause of acquired epilepsy in developing countries
• Highest prevalence is found in areas where pork is undercooked or general environmental conditions are unsanitary (high in Latin America, Southeast Asia, Africa, and Eastern Europe, shown on map)
• It can present variably depending on the location and stage of cysts in the nervous system
• Most common presentation: seizures, usually focal and brief
• Can also have headache and vomiting

Diagnosis? Made by either CT or MRI

Treatment? Steroids to reduce cerebral edema, control seizures with an antiepileptic medication

Complications? Cysts on the outside of the brain tissue (extraparenchymal NCC) can cause intracranial hypertension, hydrocephalous and chronic meningitis → surgical intervention is required in many of these cases

Prognosis?

• seizure recurrence rate is low in cases with single lesions
• those with multiple, persistent or calcified lesions usually have recurrent seizures and require surgery to remove the cyst, as above
Case Presentation
In the Emergency Room...

- Jessica Gonzalez, a 29 year old female, just arrived at the emergency department with her husband Ruben. Her husband tells you that they were at home cooking dinner when all of a sudden Jessica fell to the ground and her body went really stiff.
- Alarmed, he called out her name but she wasn’t responding. She seemed to let out a big puff of air and then all of a sudden her legs and arms started shaking uncontrollably. It all lasted 1-2 minutes although he was so worried that “it seemed like forever!”

- When the shaking stopped her body seemed to relax and she regained consciousness but she didn’t seem to realize what had happened and had a horrible headache.
- As soon as Ruben realized that he could get her up, he took her right to the car and drove her straight to the hospital!
Jessica’s history

- Jessica tells you that she doesn’t remember anything except for when she realized she was on the floor. Now her head hurts, her muscles ache and she feels really tired.
- When asked a few questions about her past medical history she tells you that she’s been pretty healthy all of her life. She has never had anything like this happen to her before and has never heard of a seizure disorder or any other form of brain disease in her parents or 5 brothers or sisters.

They continue to tell you that they got married a couple months ago in a huge wedding in Jessica’s hometown of Guadalajara with all of their very large extended family and friends.

- Jessica was born in Guadalajara and lived there until she was 18 when she came to San Diego for to attend UCSD.
“What is wrong with me, doctor?”

- “What is wrong with me, doctor? Am I going to be ok?” Jessica asked.
- You reassure her that you are going to do your best to get to the bottom of this. You call over your very competent medical student, Brian, to do a full physical exam and work up.

Activities
Recap
What do we know about Jessica so far?

What is a seizure?
- Episode of irregular and disorganized electrical activity in the brain
- There are different types of seizures with different symptoms depending on the region of the brain affected
- Jessica seems to have had a tonic-clonic seizure
  - Tonic = constant contraction of the muscles
  - Clonic = shaking of the limbs
What can cause a seizure?

- Usually involves some injury to the brain
  - Head injuries
  - Brain tumors
  - Lack of oxygen
  - Infections in the brain
  - Abnormal levels of substances – for example, too much salt or too little sugar
- However in many cases no cause is discovered!

What tests should we run?

- Physical exam! Check all cranial nerves
- Lumbar puncture: could it be an infection?
- Imaging of the brain: MRI or CT scan
Work-up

- Brian immediately scheduled an MRI scan and lumbar puncture for Jessica.
- In the meantime as he waiting for her scan, Brian did a full cranial nerve exam on her. He found that her sense of smell was diminished and she seemed to have some visual disturbances. Hmmm...

Test Results

- The lumbar puncture showed that the cerebral spinal fluid had an increased number of white blood cells.
- When the MRI was done, the technician paged you and Brian right away and said “You’re going to want to take a look at this".
You tell Jessica that she has **neurocysticercosis**.

Caused by *Taenia solium* – a tapeworm that forms larvae that travel to the brain and form cysts.

The cyst causes inflammation in the brain → seizure.

Acquired by eating contaminated food – usually from raw/undercooked pork.
Particularly common in Mexico & Latin America, Asia & Sub-Saharan Africa

How is it treated?

- Anti-parasitic oral medication to kill the tapeworm
  - Praziquantel or albendazole
- Steroid to reduce the inflammation in the brain
- Anti-seizure oral medications to prevent future seizures
- In severe cases, neurosurgery can be done to remove the cysts
Any questions?

THANK YOU!
George Edwards, a 54 year old man, has an appointment with his primary care physician today for an yearly check up...

although it has been a few years since George was last in to see his doctor.
“I’m all the time, thirsty doc!”

- He admits that he has waited too long to schedule an appointment, but “life has been busy”. His daughter had a baby boy, his first grandchild a little over a year ago and him and his wife have had to take on a lot of the babysitting responsibilities!

- Everything else has been pretty good, he states, although he has been noticing that he has been really thirsty lately.

“I’m thirsty all the time, doc!”

- He drives a public bus so this increased thirst has been kind of an issue.

- “I bring my water bottle with me on the bus but end up drinking the whole thing before my first break and it’s a problem because drinking so much makes me have to use the bathroom very often and very badly... and there isn’t a bathroom on my bus!” he explains.
“I’m thirsty all the time, doc!”

- After checking George’s heart and lungs you don’t notice anything unusual. However, he has gained 20 lbs since you last saw him. His BMI of 31 now puts him in the obese category.

- You are also concerned about George’s increased thirst and ask that he come in fasting tomorrow morning to get his blood drawn. You want to check his fasting blood sugar levels because you have a sneaking suspicion that they might be high...

BMI

\[
\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)} \times \text{Height (m)}}
\]

**BMI Chart**

- BMI less than 18.50: Underweight
- BMI 18.50 - 24.99: Healthy weight
- BMI 25.00 - 29.99: Overweight
- BMI 30 or more: Obese
The next day...

- George’s lab results are sent to you the next day. Sure enough, as you suspected, his sugar levels are too high!

<table>
<thead>
<tr>
<th></th>
<th>12/06/14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Plasma Glucose</td>
<td>176 mg/dL</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th></th>
<th>Pre-diabetes</th>
<th>Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Plasma Glucose</td>
<td>100-125 mg/dL</td>
<td>&gt;126 mg/dL</td>
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The next day...

- George’s lab results are sent to you the next day. Sure enough, as you suspected, his sugar levels are too high!

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- You call George and explain to him that his blood sugar levels suggest that he has Type 2 diabetes. You schedule an appointment for him the next day to explain everything he needs to know about diabetes.
Diabetes

- What is it?
- Who gets it?
- What is the treatment?
- What does diabetes have to do with nutrition?

Diabetes – What is it?

<table>
<thead>
<tr>
<th>Type 1</th>
</tr>
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<tbody>
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<td>~10% of diabetes cases</td>
</tr>
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<td>Pancreas cannot produce insulin</td>
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<td>Usually presents early in childhood</td>
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Diabetes – What is it?

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<tr>
<th></th>
<th>Type 1</th>
<th>Type 2</th>
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<tbody>
<tr>
<td>~10% of diabetes cases</td>
<td>~90% of diabetes cases</td>
<td></td>
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<tr>
<td>Pancreas cannot produce insulin</td>
<td>Body is insulin resistant/not able to respond to insulin</td>
<td></td>
</tr>
<tr>
<td>Usually presents early in childhood</td>
<td>Can develop at any age, most common in adulthood</td>
<td></td>
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Diabetes – what is it?

- When glucose builds up in your **blood** instead of your **cells** it can cause two main problems:
  - Right away, your cells are starved for energy
  - Over time, this can cause problems for your eyes, kidneys, nerves and heart
Diabetes – what is it?

• When glucose builds up in your blood instead of your cells it can cause two main problems:
  – Right away, your cells are starved for energy
  – Over time, this can cause problems for your eyes, kidneys, nerves and heart

• Why was George needing to drink water and pee all the time?

What makes you more likely to get diabetes?

• Being overweight or obese
• Little to no exercise
• Family history of diabetes
• Ethnicity
• Older age
Why are we talking about nutrition today?

Can you name other diseases or health problems that can be prevented with a healthy diet and regular exercise?

Obesity
Diabetes
Osteoporosis
Heart disease
Hypertension
Cancer
Aging
Low educational performance
Low self-confidence
Growth impairment

Prevention is the best medicine.
Let's take a look at how the percentage of obese adults has changed in our country over the years.

Data from the CDC: [http://www.cdc.gov/obesity/data/trends.html](http://www.cdc.gov/obesity/data/trends.html)
2000

2005

- No Data
- <10%
- 10%-14%
- 15%-19%
- ≥20%

- No Data
- <10%
- 10%-14%
- 15%-19%
- 20%-24%
- 25%-29%
- ≥30%
Not only can diabetes be **prevented** by a healthy diet and exercise...

it can also be **reversed** by a healthy diet and exercise if caught early!
So what are we going to recommend to George?

So what are we going to recommend as a first line treatment for George?

Healthy diet & Exercise
What does that mean?

- George listened carefully to everything you told him about diabetes. After you were done explaining he asked:

“But what does that mean doc? What am I supposed to be eating? How much am I supposed to exercise?”

---

Reading a Nutrition Label

1. **Check serving size**
2. **Glance at calories**
3. **Determine what nutrients to eat less of**
4. **Concentrate on nutrients you should eat more of**
5. **Review the ingredients list**
How many calories are in this package?

4 servings x 90 calories = 360 calories

Calorie: energy from food

The amount you need depends on age, gender, height, weight, and activity level.

100 extra calories per day → 1 pound gained per month
Any questions about serving sizes and calories?
We do need some fat in our diet, but not a lot!

Types of fat:
- **Unsaturated fat, natural in:**
  - Olive oil
  - Fish
  - Can lower cholesterol.
- **Saturated fat, natural in:**
  - Dairy
  - Meat
  - Can raise cholesterol.
- **Trans fat, unnatural in:**
  - Processed foods
  - Margarine
  - Fried foods
  - Read “partially hydrogenated.”

Make half your grains whole to control weight and to reduce the risk of colon cancer, diabetes, heart disease, and high blood pressure.
**Eat More Whole Grains!**

- Buy brown rice instead of white
- Choose whole wheat tortillas instead of white flour tortillas
- Pick whole grain options for pastas
- Try a new whole grain like millet or quinoa
- On food labels, look for: “100% whole wheat, “whole oats,” or “whole grain”
- Eat more oatmeal
- Have some popcorn

---

**Fiber**

Eating fiber protects you from diseases and helps you stay full so that you don’t eat too much.
Any questions about fats, whole grains, or fiber?

Nutrition Facts
Serving Size ½ cup (114g)
Servings Per Container 4

<table>
<thead>
<tr>
<th>Amount Per Serving</th>
<th>Calories 90</th>
<th>Calories from Fat 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat 3g</td>
<td>5%</td>
<td>% Daily Value*</td>
</tr>
<tr>
<td>Saturated Fat 0g</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Sodium 300mg</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>Total Carbohydrate 13g</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Dietary Fiber 3g</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td>Sugars 3g</td>
<td></td>
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Protein 3g
Vitamin A 80% • Vitamin C 60%
Calcium 4% • Iron 4%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your caloric needs.

INGREDIENTS:
Oat bran, rice, corn syrup, sugar, fructose, whole grain rolled oats, dextrose, oat and fruit clusters (toasted oats [rolled oats, sugar, soybean oil, honey, molasses] sugar, rolled oats, strawberry flavored apples, corn syrup, brown sugar, natural and artificial flavors), high fructose corn syrup, vegetable oil, contains 2% or less of potassium chloride, brown sugar, natural and artificial flavor, salt, nonfat dry milk, whole wheat flour, vitamin A, B6, riboflavin, folic acid, vitamin B12.
Re-think that drink!
Sugary drinks are the largest contributor to added sugar in our diet.

Just 1 serving of a sweetened beverage may contain 68 grams of sugar. (Recommended daily amount is 20-36 grams!)

A person’s risk for obesity increases 60% with each additional daily serving of soda.

Sweetened drinks account for a high number of extra, non-nutritious calories.

How can we drink less sugar?
• Buy only 100% juice
• Dilute sweetened beverages with water
• Replace sugary drinks with flavored water at home
• Try adding a fresh slice of lemon, lime, or orange to water for a better taste
• Have sodas on weekends only as a treat
• Choose water when eating out – it’s free!
**Vitamins & Minerals**

- **Vitamin A** is important for the eyes and skin. It also helps keep you from getting sick.

- **Vitamin C** is important for preventing diseases and healing injuries.

- **Calcium** is important for bone health.

- **Iron** is important for the blood and helps you have energy.

---

### Nutrition Facts

**Vitamin A**
- 80% of the % Daily Value

**Calcium**
- 4% of the % Daily Value

**Iron**
- 4% of the % Daily Value

**Nutrition Facts**

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**The Five and Twenty Rule**

- **5 percent or less is LOW**
- **20 percent or more is HIGH**
Your turn: which is more nutritious?

1. Check serving size
2. Glance at calories
3. Determine what nutrients to eat less of
4. Concentrate on nutrients you should eat more of
5. Review the ingredients list

Any questions about sugar, vitamins & minerals, or the nutrition label in general?
Guess what’s on the plate!

Make half your plate fruits and...
Make half your plate fruits and vegetables.

Make half your grains whole.
Go lean with protein.

Consume calcium-rich foods.
Any questions about MyPlate or fruits & veggies?

And don’t forget to exercise!

30-60 minutes daily!
## Benefits of Exercise

1. Helps you stay healthy so you don’t get sick
2. Reduces stress
3. Helps your brain function better
4. Makes you feel more confident
5. Keeps your bones strong so you are less likely to break a bone
6. Gives you more energy
7. Helps you sleep better
8. Gives you something fun to do
9. Helps you keep a healthy weight
10. Keeps your heart healthy

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**Thank you!!!**