



UC DAVIS VETERINARY MEDICINE

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CAHFS Accession #: S2101099

FINAL REPORT

Ref.#: [redacted] elephant

Coordinator: Javier Asin Ros, DVM, PhD, Dipl. ECVP

E-Signed and Authorized by: Asin Ros, Javier on 4/1/2021 8:41:13AM

Email To: [redacted]

Collection Site: [redacted]

This report supersedes all previous reports for this case

Specimens Received: 1 Carcass;

Date Collected: 02/05/2021 Date Received: 02/05/2021

Case Contacts

| | | | | | | |
|-----------|------------|------------|------------|------------|------------|------------|
| Submitter | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Report To | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Report To | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Report To | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

Specimen Details

| Animal/Source | ID Type | Taxonomy | Gender | Age |
|---------------|---------|------------------|--------|-------|
| [redacted] | Name | African Elephant | Female | Adult |

Laboratory Findings/Diagnosis

A female African elephant [redacted] that died with a 17-day history of gastrointestinal disease

Colonic sand impaction ("sand colic"), with obstruction, ruptured cecum, peritonitis, and sepsis/endotoxemia

Main gross/microscopic diagnoses and lab test results

1. Cecum:
 - a. ~25 cm tear/rupture of the wall with release of contents (forage) to abdominal cavity
 - b. Dissecting hemorrhage and necrosis of the ruptured wall
 - c. Streptococcus sp., Lactobacillus spp. isolated; cecal tear
2. Colon: Abundant, dense sandy material with variably-sized stones ("sand impaction"; likely predisposing factor for #1)
3. GI serosae, mesentery, omentum, abdominal cavity:
 - a. Serositis/peritonitis, fibrinous, with bacteria and vegetal material (secondary to #1)
 - b. Abundant (~10 L) turbid fluid with strands of fibrin and forage
 - c. Enterococcus faecium isolated; peritoneum
4. Spleen: Perisplenitis/capsulitis, fibrinous, diffuse, with bacteria and vegetal material (secondary to #1)
5. Liver: Perihepatitis/capsulitis, fibrinous, diffuse, with bacteria and vegetal material (secondary to #1)
6. Heart: Multifocal epicardial petechiae (likely related to sepsis/endotoxemia; secondary to #1, #3)

Other gross/microscopic diagnoses and lab test results

1. Liver:
 - a. Congestion, centrilobular, marked (likely agonal)
 - b. Streptococcus lutetiensis isolated (likely terminal/contaminant)
2. Lungs:

- a. Congestion, diffuse, with rare organizing intravascular fibrin (likely agonal and/or related to sepsis/endotoxemia)
- b. No bacteria isolated
3. Frontal bone: Simple, closed, non-displaced fracture w/ scant vascular reaction (most likely postmortem)
4. Uterus, horns: Papilliform exophytic serosal fibrous growths (incidental)
5. Vulva: Multiple exophytic growths with a fine stalk (papillomas; gross diagnosis)
6. Subcutis, abdomen: Subcutaneous edema, regionally extensive (likely related to sepsis/endotoxemia and/or recumbence)
7. *Streptococcus* sp, *S. equinus*, *Lactobacillus* spp isolated; small intestine, colon, cecum (likely terminal/incidental)
8. *C. bifermentans*, *C. perfringens* (not typed) isolated; small intestine, colon, cecum (likely terminal/incidental)
9. Negative *C. perfringens* and *C. difficile* toxins ELISA; small intestine, colon, cecum
10. No *C. difficile* detected; small intestine, colon, cecum
11. No *Salmonella* sp detected; liver, lymph node, small intestine, colon, cecum, peritoneum
12. No bacteria isolated; spleen
13. No parasite eggs/oocysts detected; feces
14. Unremarkable mineral concentrations; liver

Case Summary

02-08-21: Main necropsy finding in this elephant was a ruptured cecum, with release of contents to the abdominal cavity, and severe peritonitis. This was the most likely main contributor to this animal's death, most likely via endotoxemia/sepsis. A segment of colon adjacent to the cecum contained abundant and very compacted sand. This likely caused a degree of intestinal obstruction, colic, and acted as a predisposing factor for cecal rupture. We are doing histology (microscopic examination of selected tissue samples) and other diagnostic procedures to better characterize these findings and perhaps identify other disease processes. Results will be included in subsequent versions of this report. Please, do not hesitate to contact us if you have any question.

04-01-21: All testing has been completed. Histology confirmed severe damage to the cecal wall at the point of rupture/tearing and marked fibrinous peritonitis with vegetal material/gastrointestinal content. As anticipated in the preliminary report, this most likely lead to sepsis/endotoxemia and death. While removing the brain, a fracture in the surface of the frontal bone was noted. There was no much vascular reaction (i.e., hemorrhage/hematoma) associated with it or in other parts of the head, so this fracture likely occurred either postmortem (perhaps while loading the carcass into the truck?) or shortly prior to death (perhaps the animal felt/hit herself when colicking or at the moment of death?). The rest of the gross and microscopic findings and laboratory test results are either related to sepsis/endotoxemia, unremarkable/non-diagnostic, or incidental. This concludes testing.

Clinical History

Duration of illness: 17 days

On 1/16, we began noticing some ventral edema on our female Afr. elephant, [REDACTED] which had increased significantly by 1/17. We'd seen this before in [REDACTED] medical history as well as other elephants in our care so we treated her homeopathically as we had in the past with the inclusion of cooked "coffee-grounds" in her daily grain as a diuretic. She responded well and the edema was reduced significantly within days as it remains today therefore that treatment has been discontinued.

1/19 was the morning after a renowned storm here in [REDACTED], with record rains, winds, mud-slides, emergency warnings, evacuation orders, etc... So it was a long and noisy night of wind and rain pelting their barn with constant sirens responding to mud slides and floods around the [REDACTED]... We found [REDACTED] in her night stall displaying her typical signs of colic that morning, holding one foot off the ground, lying down and getting up and refusing food and water ~ her typical signs of colic with one exception, she was passing normal stool. She had stool in her stall but not as much as normal however she had not eaten her normal diet either. [REDACTED] has a long history of colic and being treated for it as she's always been a bit neurotic and anxious about any and all changes or abnormalities to her environment... We began our typical treatment of Banamine (30cc) twice daily along with attempts to give her grain/mineral oil as well as browse and exercise. This went on with sporadic positive results for two days, which again, is not uncommon for [REDACTED]. We continued to see stool in amounts expected based upon her minimal food consumption. The longest recovery I recall her having for colic was approx. 4-6 days with a large amount of gravel etc... in her stool when it finally passed. Her stool from the beginning of this episode remains clear and well formed.

Storm conditions required that both our elephants remain indoors for the following two days to assure their health-wellbeing and safety however, that is not a circumstance they are unfamiliar with.

On 1/21, we noticed [REDACTED] had chewed-up food (hay) that had been spit out on the floor of her stall. Not a lot but enough to be obvious of what it was. So we began thinking she could possibly be pushing a tooth and having trouble chewing or have an infection in it. We'd seen this behavior in the past with an elephant that had extreme food allergies which resulted in swelling of its throat ~ prohibiting swallowing ~ however [REDACTED] had no history of such nor did she have any other symptoms that we'd seen in the other elephant when this occurred (hives, swelling of other areas, etc...) When [REDACTED] did drink or eat, she seemed to swallow comfortably and there have been no changes to our hay source/supply. [REDACTED] Unfortunately, she refuses to allow us to get a good look at her teeth when she's feeling poor (for fear of our attempting to medicate, feed or water her...) therefore we've had limited ability to view the entire mouth however the two forward upper teeth sections we've been able to view and photograph seem normal. (See attached photo) We also sent blood work into the lab on this day for concern of her condition being more than just colic. (See attached lab results.) Lab results didn't seem to flag anything significant so we continued treatment for colic as she has had longer bouts of colic in the past. Continued sporadic positive results continued.

On 1/29, she just wasn't back to normal yet. We also noticed an elevated body temperature on this day of approx.. 100.5. and decided to begin a course of antibiotics, 100cc Enroflox 100mg/ml daily along with the daily Banamine treatment. Again, her response remained sporadically positive, going on and off food, drinking approx. 10-20 gallons of water throughout the day and night. We sent another blood sample into the lab on this day to compare and continue to monitor. (See attached results of 1/30)

1/30, her body temp throughout the day was 98-98.5f, slightly more normal but a bit elevated therefore we continue with both the anti-biotic and Banamine protocol as well as offering grain with mineral oil, browse, different types of hay and exercise. This is where we remain today. We haven't caught a fresh stool sample for a temp yet today. She seems to feel better, as expected, several hours after receiving the drugs, when she'll eat and drink some, but still not herself, still resting a foot on the bars. Stool is still moving but loose. She's one hour past getting her drugs this morning and she is once again nibbling on grass hay and palm browse as well as having just consumed approx. 7 gallons of water. Her response to ques for behaviors is normal and alert. We brought [REDACTED] on board at this point as he'd helped us many times over the years our elephants I recommended we send blood, urine and stool to [REDACTED] for detailed testing (which we did on 1/31.)

On 1/31, her temp was down to normal, 97-98F, and has remained so since however per the recommendations of [REDACTED], we are continuing the above drug protocol for a couple more days. She did begin presenting her teeth as normal of which we photographed however both [REDACTED] and [REDACTED] felt there appeared to be no abnormalities or dental concerns visible.

2/1-2 continue to see increased appetite and water intake (17 gallons in one sitting last night) but only after a Banamine dose. Things were actually looking up. We did receive our first test results back from [REDACTED] (attached) to which [REDACTED] responded with:

[REDACTED] appears to have a left shift (increased neutrophils and numerous bands) In addition the LDH (an enzyme that indicates some liver inflammation) with elevated CPK which indicates inflammation or damage primarily to muscle tissue. The SAA acute phase protein is elevated but not highly elevated indicating acute inflammation. To me, the first on my list is to treat for salmonella in an African elephant. And continue to monitor with samples to [REDACTED] a couple of times a week.

On 2/3/21, we per the recommendation of my colleague and director of the [REDACTED] we added elephant expert, [REDACTED] onto the team and forwarded her all the attached information and info above. She first felt our Banamine treatments might be excessive in dose therefore she recommended discontinuing the Banamine and replacing it with a low dose of Butorphanol for pain. She also recommended treating with Omeprazole in the event her stomach was upset or ulcerated from the Banamine. I'll forward her email to you after this one so you can read her recommendations directly.

2/4/2021, we are unfortunately seeing [REDACTED] moving a bit slower and refusing food and water therefore [REDACTED] and [REDACTED] agreed a 40cc regiment of Dex might be beneficial. I am awaiting [REDACTED] opinion on that. She also mentioned the use of Ursodiol on elephants for elephants with chronic GI issues however I've yet to discuss that further with her. All agreed to continue the antibiotic as well as discontinue the Banamine and get the pantoprazole on its way for tomorrow. That's where we're at today. Salmonella test results from the first sample are still pending with another sample going in today.

Today on 2/5/2021, we unfortunately found [REDACTED] deceased in her night stall. There were no apparent signs of stress or struggle, she was found in her normal sleeping position deceased. Her body was removed from the barn and transported to CAHFS San Bernardino.

Addendum 02/06/2021: When [redacted] was found in the morning she was on her left side. In addition rigor mortis had set in. When we removed her from her stall her skin on her belly suffered some abrasions, this was postmortem. I noticed some what appeared to be milk coming from her mammary glands, while the glands were not engorged there was a small amount of milk being discharged.

Gross Observations

Necropsy of an adult, female African elephant began at 9.40 am, Saturday, February 06, 2021.

Carcass is in good nutritional condition, with ample fat reserves and well fleshed, mildly dehydrated, and in mild state of postmortem decomposition.

There are multifocal areas (~2-4 cm) of skin abrasion and ulceration in the caudal abdomen. Mammary glands ooze scant, viscous, milky fluid upon slight pressure. There is regionally extensive, moderate subcutaneous edema in the caudal region of the abdomen and inguinal area. Two 0.5-1 cm exophytic cutaneous growths with a fine stalk (papillomas) are detected in the vulva.

Approximately 10 L of turbid, yellowish to light red fluid with strands of yellowish and friable material (fibrin) and forage fragments (gastrointestinal contents) oozes from the abdominal cavity upon incision of the wall. Diffusely, gastrointestinal serosae, mesentery, and omentum are dark red in color, with multiple petechial hemorrhages, and firmly attached aggregates of fibrin and forage fragments. Stomach contains scant forage and whole grains within an abundant viscous matrix, and gastric mucosa is unremarkable. The mucosa of a ~1 m segment of jejunum is yellowish, and there are faint, slightly raised foci. Small intestine contains abundant, watery, yellowish digesta. There is a ~25 cm tear/rupture in the apical third of the cecal wall, with raised, thickened (~1 cm), firm, dark red borders, and regionally extensive hemorrhage with fibrin and forage attached to the adjacent cecal serosa. Cecal contents consist of long fragments of forage and scant fluid, and the cecal mucosa is grey to greenish and mildly edematous. A ~75 cm segment of colon immediately after the cecum contains abundant, gritty, very compacted sandy material with irregular stones, some fragments of forage, grain, and moderate amount of fluid. The remaining colonic contents consist of densely packed vegetal material, scant grain, and scant fluid, and the colonic mucosa is diffusely greyish. There are well formed feces in the rectum.

Splenic capsule is markedly thickened by firm aggregates of fibrin and forage, and there are multifocal to coalescing areas of dark red discoloration. Cut section of the liver reveals a marked lobular pattern. There are multiple, 0.3-1 cm, cauliflower-like, exophytic growths in the serosa of the uterine horns. Lungs are diffusely dark red and spongy. There are multiple petechiae in the epicardium.

All else is unremarkable.

Addendum (02-12-21): Brain removal and head examination

The skin of the forehead and poll is removed. An approximately 30 x 20 cm area in the surface of the frontal bone is sunken up to 5 cm by a closed, non-displaced, mildly comminuted fracture; the overlying subcutaneous tissue is mildly (~8 cm) blood tinged (probably postmortem). There are no abnormalities in the inner side of the frontal bone and sinuses. The brain is removed and there are no gross abnormalities to note. There is abundant pooled blood in the left side of the skull and sinuses (probably due to recumbence on that side). There are no other gross abnormalities to note in the rest of the structures of the head.

Bacteriology

2-12-21 MALDI-TOF Biotyper testing identified the isolate as *Lactobacillus mucosae*.

2-23-21 MALDI-TOF Biotyper testing identified Isolate #3 as *Terrisporobacter glycolicus*.

2-23-21 MALDI-TOF Biotyper testing identified Isolate #8 as *Hungatella effluvii*.

BACTERIAL AEROBIC CULTURE

| Animal/Source | Specimen | Specimen Type | Results |
|---------------|------------|---------------|---------------------------------------|
| [redacted] | [redacted] | Liver Swab | <i>Streptococcus lutetiensis</i> Mod# |
| [redacted] | [redacted] | Lung Swab | No growth after 48 hours |
| [redacted] | [redacted] | Splenic Swab | No growth after 48 hours |

| | | | |
|---|----------------|-----------------------|--|
| █ | █ - lymph node | Swab | Streptococcus equinus Rare# Mixed flora Rare# |
| █ | █ | Small Intestinal Swab | Streptococcus equinus Mod# Pediococcus pentosaceus Mod# |
| █ | █ | Cecal Swab | Streptococcus sp. Mod# Lactobacillus spp. Mod# |
| █ | █ | Colon Swab | Streptococcus sp. Mod# Lactobacillus spp. Mod# Mixed flora Rare# |
| █ | █ | Peritoneal Swab | Enterococcus faecium Mod# Mixed flora Rare# |
| █ | cecal tear | Swab | Streptococcus sp. Mod# Lactobacillus spp. Mod# Mixed flora Mod# |

BACTERIAL ANAEROBIC CULTURE

| Animal/Source | Specimen | Specimen Type | Results |
|---------------|----------|-----------------------|--|
| █ | █ | Small Intestinal Swab | Clostridium bifermentans Mod# Mixed Flora Sm# |
| █ | █ | Cecal Swab | Mixed Flora Mod# Clostridium perfringens Mod# |
| █ | █ | Colon Swab | Mixed flora - No significant organisms Sm# |

Biotyper Organism Identification

| Animal/Source | Specimen | Specimen Type | Results |
|---------------|-------------|------------------------------------|--|
| █ | Isolate #1 | Bacterial Isolate, Liver | Streptococcus lutetiensis |
| █ | Isolate #2 | Bacterial Isolate | Streptococcus equinus |
| █ | Isolate #3 | Bacterial Isolate, Small Intestine | Pediococcus pentosaceus |
| █ | Isolate #4 | Bacterial Isolate, Small Intestine | Streptococcus equinus |
| █ | Isolate #5 | Bacterial Isolate, Cecum | Streptococcus sp. |
| █ | Isolate #6 | Bacterial Isolate, Cecum | Lactobacillus spp. See Discipline Summary |
| █ | Isolate #7 | Bacterial Isolate, Peritoneum | Enterococcus faecium |
| █ | Isolate #8 | Bacterial Isolate | Streptococcus sp. |
| █ | Isolate #9 | Bacterial Isolate | Lactobacillus spp. See Discipline Summary |
| █ | Isolate #10 | Bacterial Isolate | No significant match found |
| █ | ana Isol #3 | Bacterial Isolate, Cecum | See Discipline Summary |
| █ | ana Isol #8 | Bacterial Isolate, Colon | See Discipline Summary |

C. perfringens Toxins ELISA

| Animal/Source | Specimen | Specimen Type | Analyte | Result | Units |
|---------------|----------|---------------------------|----------------|-------------------------|-------|
| █ | █ | Small Intestinal Contents | Alpha toxin | alpha toxin negative | |
| | | | Beta toxin | beta toxin negative | |
| | | | Epsilon toxin | epsilon toxin negative | |
| | | | C. perfringens | C. perfringens positive | |
| █ | █ | Cecal Contents | Alpha toxin | alpha toxin negative | |
| | | | Beta toxin | beta toxin negative | |
| | | | Epsilon toxin | epsilon toxin negative | |
| | | | C. perfringens | C. perfringens positive | |
| █ | █ | Colon Contents | Alpha toxin | alpha toxin negative | |
| | | | Beta toxin | beta toxin negative | |
| | | | Epsilon toxin | epsilon toxin negative | |
| | | | C. perfringens | C. perfringens negative | |

C. difficile Toxins ELISA

| Animal/Source | Specimen | Specimen Type | Results |
|---------------|----------|---------------------------|----------|
| █ | █ | Small Intestinal Contents | Negative |
| █ | █ | Cecal Contents | Negative |
| █ | █ | Colon Contents | Negative |

CLOSTRIDIUM DIFFICILE CULTURE

| Animal/Source | Specimen | Specimen Type | Results |
|---------------|----------|-----------------------|-----------------------------------|
| █ | █ | Small Intestinal Swab | No Clostridium difficile detected |
| █ | █ | Cecal Swab | No Clostridium difficile detected |
| █ | █ | Colon Swab | No Clostridium difficile detected |

SALMONELLA CULTURE - MAMMALIAN

| Animal/Source | Specimen | Specimen Type | Results |
|---------------|----------------|-----------------------|----------------------------|
| █ | █ | Liver Swab | No Salmonella sp. detected |
| █ | █ - lymph node | Swab | No Salmonella sp. detected |
| █ | █ | Small Intestinal Swab | No Salmonella sp. detected |
| █ | █ | Cecal Swab | No Salmonella sp. detected |
| █ | █ | Colon Swab | No Salmonella sp. detected |
| █ | █ | Peritoneal Swab | No Salmonella sp. detected |

Histology

Sections from lung, liver, lymph nodes, mesenteric fat, adrenal gland, kidney, trachea, heart, spleen, haired skin, aorta, skeletal

muscle, urinary bladder, mammary gland, skeletal muscle, tongue, stomach, small intestine, colon, cecum, uterus, and brain (frontal cortex, basal nuclei, parietal cortex, thalamus/hypothalamus, hippocampus, midbrain, cerebellum, and medulla) are examined with significant changes summarized:

SMALL INTESTINE/COLON/CECUM/MESENTERY

Diffusely, the intestinal serosae are expanded by a fibrillary eosinophilic material (fibrin) with neutrophils and karyorrhectic debris, colonies of coccobacilli and bacilli, and abundant vegetal material (gastrointestinal content); similar components are in the mesenteric fat (serositis and peritonitis). There is hemorrhage that dissects the adjacent external side of the muscular layer. In some sections, hemorrhage and fibrin tend to spread inwards the more inner muscular layers, even reaching the submucosa, which is expanded by clear spaces and dilated lymphatics (submucosal edema). In sections of cecum close to the borders of rupture, hemorrhage, necrosis, and neutrophilic inflammation transmurally affect the entire wall, and there is also fibrinoid necrosis of the vessels, with leukocytoclastic vasculitis, and rare thrombosis.

LUNG

There is diffuse and severe septal congestion, rare aggregates of intrascular fibrin, and macrophages with intracytoplasmic granular pigment associated with some airways (pneumoconiosis; incidental).

LIVER

There is marked centrilobular congestion. Diffusely, hepatocytes contain intracytoplasmic, light brown pigment. There are centrilobular and periportal aggregates of macrophages with dark brown intracytoplasmic pigment (hemosiderosis). There are scant aggregates of fibrin and bacteria overlying the capsule of some of the sections.

SPLEEN

The capsule is multifocally overlaid by fibrin, neutrophils, debris, and bacteria. There is prominent hemosiderosis.

LYMPH NODES

There are several lymph nodes with marked congestion

KIDNEY

There are multifocal groups of tubuli with intracytoplasmic, light brown granular pigment in the epithelium. Basement membranes are mildly thickened. There is mild thickening of the glomerular capsules by scant fibrous tissue. There is slight mineralization in the glomerular capsules and tubular basement membranes.

HAired SKIN

There is marked orthokeratotic hyperkeratotic with debris and abundant superficial coccoid bacteria.

UTERUS

There are pedunculated, papilliform outgrowths in the serosal layer composed of a core of dense collagen bundles.

Parasitology

Test Specific Comments

FECAL EXAM - FLOTATION

- * < 10 per slide in a concentration method is consistent with very few eggs present in the sample. >= 10 per slide in a concentration method is consistent with a notable presence of eggs in the sample.
- * Fecal flotation requires at least 1g to provide accurate results. It is a qualitative method that concentrates eggs present in the sample to maximize their detection. A Modified McMasters exam, which requires at least 3 g, is recommended for semi-quantitative information about the number of eggs present per gram of feces, which may aid in clinical assessment and treatment decisions. If <3 g is available, a flotation exam is performed.

FECAL EXAM - FLOTATION

| Animal/Source | Specimen | Specimen Type | Results |
|---------------|----------|---------------|---------------------------|
| █ | █ | Feces | No parasite eggs detected |

Toxicology

Reporting Limit (Rep. Limit): The lowest routinely quantified concentration of an analyte in a sample. The analyte may be detected, but not quantified, at concentrations below the reporting limit. Sample volumes less than requested might result in reporting limits that are higher than those listed.

Note that we don't have established "normal" liver mineral ranges for this species. However, the detected concentrations are unremarkable.

HEAVY METAL SCREEN

| Animal/Source | Specimen | Specimen Type | Analyte | Result | Units | Rep. Limit | Units |
|---------------|----------|---------------|------------|--------------|-------|------------|-------|
| █ | █ | Liver Tissue | | | | | |
| | | | Arsenic | Not Detected | ppm | 1 | ppm |
| | | | Cadmium | 6.6 | ppm | 0.3 | ppm |
| | | | Copper | 5.7 | ppm | 0.3 | ppm |
| | | | Iron | 690 | ppm | 1 | ppm |
| | | | Lead | Not Detected | ppm | 1 | ppm |
| | | | Manganese | 1.8 | ppm | 0.1 | ppm |
| | | | Mercury | Not Detected | ppm | 1 | ppm |
| | | | Molybdenum | 2.8 | ppm | 0.4 | ppm |
| | | | Zinc | 43 | ppm | 0.3 | ppm |

SELENIUM - TISSUE/OTHER

| Animal/Source | Specimen | Specimen Type | Results | Units | Rep. Limit |
|---------------|----------|---------------|---------|-------|------------|
| █ | █ | Liver Tissue | 0.66 | ppm | 0.020 |

Phone Log

| Client Contact | CAHFS Contact | Date and Time | Subject |
|----------------|------------------|----------------|------------------------------|
| █ | Asin Ros, Javier | 2/6/21 2:00 pm | Preliminary necropsy results |

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