

Case series evaluation: ACTISORB® Silver 220 in practice



WoundsUK

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Activated charcoal and silver for odour control, and antimicrobial and anti-inflammatory effects

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ACTISORB® Silver 220 (Systagenix) is composed of a sealed non-woven nylon sleeve containing activated charcoal impregnated with metallic silver. It has been indicated for use as an antimicrobial and odour-control dressing for more than 25 years (Hampton, 2001; Leak, 2002; Keriheul, 2009; 2010; White, 2013).

Charcoal is extremely porous on activation, a process in which the charcoal is heated to approximately 1000°C in the absence of oxygen, achieved either by steaming or heating in a vacuum (Marsh and Rodriguez-Reinoso, 2006). The result is activated charcoal, with large pores that increase the surface area of the charcoal, which increase its adsorption capabilities. It also has been shown that an activated charcoal dressing — such as ACTISORB Silver 220 — can adsorb bacteria, viruses and various other biochemicals *in vitro* and *in vivo* (Drucker et al, 1977; Naka et al, 2001). Cell lysis produces endotoxins, which have an inflammatory effect and can disrupt the healing process; activated charcoal also adsorbs these endotoxins, thus giving it anti-inflammatory properties (Fleck, 2006).

Silver has long been shown to have an antimicrobial effect and has been used for medicinal purposes since the 19th century (White, 2001). Discussion on the antimicrobial action of silver in wound care has centred on interference with the bacterial electron system, binding to DNA of bacteria and spores, impairing cell replication, and binding causing receptor function and structural damage (Thurman and Gerba, 1989). In ACTISORB Silver 220, bacteria are bound to the activated charcoal cloth fibres and in addition to the adsorption effect, silver ions kill the bacteria and so reduce bacterial burden in the wound. Keriheul (2009) also suggested that ACTISORB Silver 220 participated in the reduction of biofilm growth.

EVIDENCE FOR ACTISORB SILVER 220

Clinical studies have demonstrated activated charcoal cloth with silver to be effective in reducing malodour and exudate in leg ulcers; researchers have also suggested it was cost-effective in terms of reduced frequency of dressing change and improved healing compared to prior treatments (Millward, 1991).

Studies have shown that chronic wounds dressed with activated charcoal cloth with silver exhibit reduced bacteria levels after 2 weeks (Verdú Soriano et al, 2004). Keriheul (2010) found an increase in signs of healing in leg ulcers (ACTISORB Silver 220) and reductions in the wound area within a week using ACTISORB Silver 220. Adverse event incidence was low, and the dressing was well tolerated.

These findings are supported by other studies that have demonstrated improved healing rates in leg ulcers (Wunderlich and Orfanos, 1991). Further work on leg ulcers and pressure ulcers by Tebbe and Orfanos (1996) demonstrated a reduction in frequency of dressing change, a reduction in the time to change the dressing, a reduction in wound size, and an increase in granulation and epithelial tissue in both leg and pressure ulcers. Keriheul and Dujardin-Detrez (2003) found similar results, with clinical benefit identified across a variety of wound situations.

USING ACTISORB SILVER 220

In addition to activated charcoal and metallic silver, ACTISORB Silver 220 features a non-woven nylon sleeve that reduces the risk of adherence to the wound bed, reducing trauma on removal. The dressing is not designed to absorb exudate, so it may need to be used with a secondary absorbent dressing in wounds with moderate to heavy levels of exudate.

The ACTISORB Silver 220 instructions for use leaflet — found inside the product packaging — should always be referred to before use. The dressing should be removed before magnetic resonance imaging or radiotherapy (Wounds UK, 2013).

In addition to the specific indications of the product, ACTISORB Silver 220 may be useful in managing malodour and bacterial burden and the associated signs in the following wound types, as will be explored in the case series that follows:

- Friable/overgranulated tissue
- Percutaneous endoscopic gastrostomy tubes
- Malignant/palliative wounds
- Necrotic toes
- Fungal infection (Table 1, p3).

CONCLUSION

The case series evaluation shows the wide range of wounds for which the combination of activated charcoal and metallic silver can achieve treatment goals including elimination of infection, control of malodour and progress towards healing. In all cases, ACTISORB Silver 220 was found to be easy to fold and position, staying in place over a variety of anatomical areas with a range of sizes. Patients were very comfortable with the dressing, and dressing-change pain was low across the board. Patients also reported improvement in quality of life due to resolution of malodour, which tended to make them very self-conscious and embarrassed.

Overall, the literature and this series of case studies promote the role of an activated charcoal/metallic silver dressing as an effective and viable option for managing infection, odour and healing.

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TABLE 1 | Clinical rationale for ACTISORB® Silver 220

Clinical presentation	Issues	Rationale for ACTISORB Silver 220	Tips for use
Friable/overgranulated wounds	Can be caused by a high bacterial load at the wound surface, prolonging the inflammatory phase of healing (McGrath, 2011)	<ul style="list-style-type: none"> ■ Contains silver to reduce the bacterial load ■ Lets exudate filter through, removing it from the wound surface 	<ul style="list-style-type: none"> ■ Apply directly to the wound bed, with or without a non-adherent wound contact layer ■ Avoid excess grease or ointment
Percutaneous endoscopic gastrostomy (PEG) tubes	Under normal circumstances, PEGs do not require a dressing, but the site should be kept clean and dry. However, because PEGs are effectively a foreign body, they can irritate the surrounding skin, as can leakage of gastric contents or feed (Slater, 2009)	<ul style="list-style-type: none"> ■ Contains silver, therefore has anti-inflammatory properties ■ Is a thin dressing, which minimises pressure to the interior flange, avoiding deterioration of the abdominal wall (Naik et al, 2009) ■ Reduces the bacterial load at the PEG site, including meticillin-resistant <i>Staphylococcus aureus</i>, which will in turn reduce inflammation (Spruce et al, 2009) and infection (Leak, 2002) 	<ul style="list-style-type: none"> ■ Insert between the PEG tube and skin
Malignant/palliative wounds	Due to the rapid multiplication of cancer cells, blood flow is compromised, resulting in reduced ability to carry byproducts of bacterial metabolism away from the wound. Such wounds therefore tend to become sloughy and, ultimately, malodorous (O'Brien, 2012)	<ul style="list-style-type: none"> ■ Topical antimicrobial dressings, such as those that contain silver, are the preferred dressing choice to manage infection in malignant wound (Naylor, 2013) ■ Activated charcoal cloth reduces malodour by adsorbing small gas and liquid odour molecules (Thomas, 2009) 	<ul style="list-style-type: none"> ■ May require a secondary absorbent dressing depending on level of exudate ■ The secondary dressing can be changed when required for strikethrough
Necrotic toes	Topical antimicrobials should be used only when there are signs that the bacterial burden is impeding healing. However, when there is poor arterial perfusion, topical antimicrobials should be considered even in the absence of clinical signs of infection (Wounds UK, 2013)	<ul style="list-style-type: none"> ■ Antimicrobial silver can reduce the risk of infection entering a necrotic area ■ Maintenance of a dry environment at the line of demarcation of gangrene can prevent deterioration ■ Prevents direct contact between gangrenous toe and viable tissue of other toes ■ Silver helps reduce the bacterial burden on the skin, to prevent cross-infection 	<ul style="list-style-type: none"> ■ Fold or wrap around an individual toe
Fungal infection	Often occur in awkward anatomical areas, where combination of warmth and moisture result in infection and odour	<ul style="list-style-type: none"> ■ Activated charcoal cloth impregnated with silver will be in contact with the wound/skin surface and has antimicrobial and anti-fungal effects ■ Dressing is lightweight and thin, letting it conform well to various anatomical sites 	<ul style="list-style-type: none"> ■ Fold or wrap around an individual toe ■ Fold and slide under breasts or in groin or abdomen folds to separate folds of skin

CASE STUDIES

CASE 1: POST-SURGICAL WOUND WITH FRIABLE/BLEEDING TISSUE

BACKGROUND

Mr M is a 39-year-old male who had undergone left shoulder surgery 9 months earlier. The incision did not heal properly, had not progressed and had become painful, leading him to seek treatment. The healed area broke down in September 2013. He was under the care of a vascular specialist for a period of time and underwent angiogram, compression therapy and other vascular treatment, but the wound still did not heal. When it began to deteriorate, the patient was referred to the plastics wound specialist clinic.

CLINICAL ASSESSMENT AND TREATMENT

Upon presentation, the 9-month-old wound measured 5cm x 3cm. It was bright red, with areas of overgranulation, and was very vascular, bleeding when touched. Tissue was very friable, and the wound edges had started to become dormant. Exudate levels were high and had recently increased greatly, according to the patient. He rated pain as an 8 of 10 on the visual analogue scale (VAS). ACTISORB® Silver 220 dressing was initiated to address the signs of infection. An absorbent soft-adherent foam dressing with an adhesive border (UrgoTul Absorb Border®, Urgo Medical) was used as a secondary dressing to manage exudate, and dressing changes were scheduled for every three days.

Week 1

After 1 week, wound size was unchanged, overgranulation was settling, and signs of healing were noted. Tissue was still friable/bleeding but had improved, exudate level was low-to-moderate, and the patient rated pain a 7 of 10 on the VAS. The patient reported improvement in quality of life, because he could see positive improvement in the wound and felt comfortable with the dressing on. The dressing was easily applied and removed. A non-adherent silicone dressing (ADAPTIC TOUCH®, Systagenix) was used as a wound contact layer, as exudate levels had reduced. Dressing-change schedule remained unchanged.

Week 2

At week 2, the wound had reduced to 4cm x 2.5cm (a 33% reduction from baseline), which indicated the wound was now on a healing trajectory. Tissue was no longer friable/bleeding. Overgranulation had settled but was still present, and exudate level was minimal. The patient rated pain a 5 of 10 on the VAS, noting that it felt as if it were associated with the deeper muscular/bony injury. Due to continued improvement in the wound, the decision was made to continue with the dressing regimen.

Week 3

After 3 weeks, the wound measured 4cm x 2cm (a 47% reduction from baseline) and continued to show signs of healing, with reduced overgranulation. Exudate levels remained minimal, and the patient reported pain associated with the original injury/surgery as 7 of 10 on the VAS. Given the good continuing progress, the dressing regimen was continued unchanged.

Week 4

After 4 weeks, the wound measured 3.7cm x 1.6cm (a 61% overall reduction). Overgranulation had resolved distally and further reduced proximally. The patient continued to have pain in the shoulder due to the deeper bony issues, but reported no wound-associated pain. ACTISORB Silver 220 was continued going forward, to bring the wound to healing.

DISCUSSION

ACTISORB Silver 220 was easy to use, remove and apply. It was comfortable for the patient, and both patient and clinician were happy with the results. With the dressing in place, the exudate, erythema, friable tissue and wound-associated pain resolved; overgranulation was all but eliminated; and wound edges began moving towards healing.



FIGURE 1. Wound upon presentation



FIGURE 2. Week 2



FIGURE 3. Week 4

CASE 2: SKIN INFECTION WITH VASCULAR WOUND

BACKGROUND

Ms A is a 74-year-old female who had pernicious anaemia, ulcerative colitis with a colectomy in 2004, a stroke 8 months prior, and a total hip replacement to the right leg 2 months prior. She had a leg ulcer of 6 years' duration that progressed but around which skin infection periodically developed. Light compression had been commenced 18 months prior and, after the most recent incident of skin breakdown, a polyhexamethylene biguanide solution had been used for cleansing and antibiotics had been administered. The patient stated she would like her life back and would like to be free of dressings.

CLINICAL ASSESSMENT AND TREATMENT

Upon presentation, the patient was malnourished, with circulation problems, mobility issues and a *Staphylococcus* infection in the wound. The wound was painful and had been dressed twice weekly, which had led to deterioration of the surrounding skin. This covered the breadth of the lower right leg, approximately 17cm in length and from 3cm to 5cm in width at any given point. Odour was present, exudate level was high, and the patient rated wound-associated pain a 7 of 10 on the visual analogue scale (VAS). It was decided to initiate use of ACTISORB® Silver 220 to help resolve these signs of infection, infection-related pustules that had formed on the surrounding skin, and the thick, adherent slough covering the large wound. A polyester mesh impregnated with hydrocolloid and petroleum jelly particles (Urgotul Duo®, Urgo Medical) was used as a secondary dressing, and two-layer light compression bandaging (Coban™ 2 Layer Lite Compression System, 3M™) was also initiated. Dressing change was scheduled twice weekly. Systemic antibiotics were continued.

Week 1

After one week, the affected area had decreased in size and was mildly sloughy. There was some blistering with adhered areas, and erythema was localised to the foot and ankle. There was mild malodour in localised areas of the wound and slight bleeding in the adhered areas. The patient rated pain a 6 of 10 on the VAS. The wound was washed with a combination of water and Oilatum cleanser, then ACTISORB Silver 220 was applied, along with two-layer light compression, with twice-weekly dressing changes scheduled.

Week 2

At week 2, the affected area decreased in size to 12cm long and from 1.5cm to 3cm across. Odour had resolved, the blistered areas were raw in appearance, and there was slight haematoserous discharge. The patient rated pain as a 7 on the VAS. After cleansing with water and Oilatum, Adaptic Touch (Systagenix) was applied as a first layer. ACTISORB Silver 220 and compression were then applied, with dressing changes twice weekly.

Week 3

After three weeks, the affected area had not reduced in size and pain level was the same, but signs of healing continued, and signs of skin infection had reduced. The skin appeared vascular and raw,

and there was slight haematoserous discharge, but the slough had resolved. The dressing regimen was continued unchanged.

Week 4

At week 4, wound size had not changed, skin infection had resolved, and there was slight haematoserous discharge. Pain level had increased to an 8 on the VAS, due to the vascular nature of the wound, and possibly due to use of compression. The wound was cleansed with water and Oilatum, and irrigated with saline. Two-layer light compression was applied. ACTISORB Silver 220 was discontinued because signs of infection had resolved.

DISCUSSION

ACTISORB Silver 220 was found to be easy to fold and position, and it stayed in place well over a large area. Use of the dressing resolved skin infection issues, and the patient reported that she felt it was very comfortable and improved her quality of life.



FIGURE 1. Wound and affected area upon presentation



FIGURE 2. Week 2

FIGURE 3. Week 4

CASE STUDIES

CASE 3: INFECTED PRESSURE ULCER

BACKGROUND

Mr S is a 62-year-old male with post-traumatic paraplegia, type 2 diabetes and peripheral arterial disease, and a history of neuropathy. He had had a pressure ulcer on his right lateral malleolus for 9 months, protected with a soft cast. Previous therapies included Biatain® (Coloplast) and Flaminal® (Crawford Healthcare).

CLINICAL ASSESSMENT AND TREATMENT

The wound measured 31mm x 24mm with punched out granulation and a crescent of slough, with non-healing friable tissue and moderate exudate. A wound swab showed *Pseudomonas* and mixed skin flora. Malodour was noticed at dressing change, and this, along with the clinical judgement that the wound was infected, led to a decision to use ACTISORB® Silver 220 dressing, changed every 2 days. A secondary dressing of Tubegauze was applied.

Week 1

After 1 week, there was still some slight wound malodour. The ulcer had reduced in size to 20mm x 22mm, and the exudate level and bioburden had decreased. The dressing had stayed in place and there was no pain on removal.

Week 2

At week 2, there was no malodour, and the wound was smaller (19mm x 20mm) and shallower (Figure 1c). The decision was made to continue with the dressing to manage the bioburden, and review in 7 days. A soft cast was used for protection.

Week 3

After three weeks, further improvements in the wound were observed. Granulation had increased, size was unchanged, and the dressing regimen was continued.

Week 4

At week 4, there was no exudate, bioburden or malodour, and the wound measured 19mm x 18mm. The decision was made to switch to foam dressing and continue with a soft cast.

DISCUSSION

The wound progressed and infection resolved with the use of ACTISORB Silver 220. The clinician was satisfied with the ease of application and removal of the dressing.



FIGURE 1. Wound at presentation



FIGURE 2. Week 1



FIGURE 3. Week 2

CASE 4: MAINTENANCE OF FOOT ULCERATION DESPITE MULTIPLE COMORBILITIES

BACKGROUND

Mr P is a 69-year-old male who is a heavy smoker, with emphysema, poor nutritional status, issues with excessive alcohol consumption, chronic kidney disease and recently developed bilateral lower-limb ischaemia. He had long-standing care in the community, administered by a GP, for ulcerations that had endured for several years. He was admitted to hospital with respiratory issues and referred to a vascular team due to peripheral vascular disease and arterial disease. The patient had required three visits per week to his GP's surgery for dressing changes, bandages were constantly wet and smelly, and his legs were painful.

CLINICAL ASSESSMENT AND TREATMENT

The patient presented with a mummified distal digit on the fourth toe of the right foot, covering an area of 2cm wide by 1cm in length, with 100% wet slough. The ulcer on the third toe on the right foot was 1.5cm x 1.5cm and 100% slough. The second toe had deep ulceration measuring 2cm x 2cm, with bone exposed and 90% slough. Deep ulceration on the great toe measured 2cm x 2.2cm, with 80% slough. There was a 3.3cm x 2.5cm area of superficial ulceration on the medial dorsum and a 2cm x 2.2cm area of superficial ulceration on the lateral dorsum. Previous treatments had included silver, honey and alginate. Slight malodour was apparent and, after removal of dressings, was intense and lingering. The odour had been present for longer than 6 weeks. The patient rated pain as 6 out of 10 on the visual analogue scale (VAS). To prevent further deterioration of the wounds, reduce bacterial count and manage odour, ACTISORB® Silver 220 was initiated. An absorbent pad was used as a secondary dressing, along with a stockinette, wool and crepe from toe to knee. Dressing changes were scheduled for every 5 days, more frequently if exudate levels required, with his practice nurse.

Week 1

The patient was readmitted for acute inpatient care due to sepsis that was urinary in origin and unrelated to the wound. He had removed the dressing before readmission, but reported no issues upon dressing removal. The wound had rapidly deteriorated due to the presence of *Pseudomonas*. Dorsum ulceration on the medial aspect had increased to 7cm x 3cm, and the lateral aspect to 7.5cm x 2.5cm; slough was thick and exudate level was high. The malodour had not reduced, and was more intense at the point of admission due to deterioration of ulcerations and extension (+2cm) of mummification of fourth toe. The bone remained marginally exposed on the second toe and palpable beneath the slough. Wound-associated pain was a 7 out of 10 on the VAS due to limb deterioration and increased ischaemia; pain associated with dressing change was a 2. Intravenous antibiotic therapy was initiated to address the urinary tract infection and haematoma that had caused sepsis. An emollient was applied for skin care of the limb. The limb was also irrigated with saline before dressing application. ACTISORB Silver 220 was continued for appropriate management of infection and due to presence of *Pseudomonas*. An absorbent pad was applied as a secondary dressing, and the dressings were secured with stockinette, wool and crepe from toe to knee.

He was also put into surgical appliance footwear. Dressing change was scheduled for the next assessment.

Week 2

At week 2, exudate levels and slough had reduced despite continued issues with limb ischaemia. Malodour was present on dressing removal, but dissipated within 5 minutes. Despite limb ischaemia and other comorbid conditions that dictated the wound would be non-healing, the ulcers remained stable in size, and maceration of the surrounding skin had decreased. The patient mobilised as ischaemia-related pain allowed; there was no pain due to the wound, and pain at dressing removal was a 2 on the VAS. Due to the reduction in exudate, he was more comfortable and was able to mobilise inside and outside the ward. Antibiotic therapy for urinary sepsis had been completed. The dressing and footwear regimen was continued unchanged, for management of infection and protection of the foot, as was use of an emollient for skin care.

DISCUSSION

The patient was discharged and no further assessment took place. Due to the patient's multiple comorbidities, healing was never a realistic outcome; hence, the goal of therapy was to improve quality of life and reduce the risk of further complications. ACTISORB SILVER 220 did positively affect the patient's quality of life by improving malodour, pain and exudate management. The dressing also satisfied the clinician's objectives as, despite many systemic issues that were deeply problematic, there was no further deterioration of the wound.

FIGURES 1A/1B. Wound and leg at presentation



FIGURES 2A/B. Wound and leg at week 1



FIGURES 3A/B. Wound and leg at week 2



CASE STUDIES

CASE 5: FUNGAL INFECTION IN SKIN FOLDS AND GROIN

BACKGROUND

Mr B is a 56-year-old male with insulin-dependent diabetes mellitus and morbid obesity. Intertrigo had developed due to the excessive weight of the skin folds, which also collected and trapped excess moisture. Before hospital admission, the patient was treated with oral antibiotics and a commercial antifungal cream for extensive Candida colonisation and infection. After more than 4 weeks' duration, Mr B was experiencing extreme discomfort and was embarrassed by the malodour.

CLINICAL ASSESSMENT AND TREATMENT

On examination, it was found that the folds were extremely malodorous and that the cream being used had been collecting in the folds and exacerbating excoriation and skin breakdown. There was generalised malodour on approach to the bed space, and intense, offensive odour when the skin folds were lifted. Dermal-level ulceration measuring 1.5cm x 1cm was present in the left groin, and epidermal loss was present in the right groin and on the abdominal apron. The patient rated pain as a 4 out of 10 on the visual analogue scale (VAS).

The decision was made to use ACTISORB® Silver 220 due to perceived antifungal properties, as well as its ability to absorb low levels of excess moisture while providing a soft, trauma-free material between the skin folds, reducing the skin-on-skin friction. Good skin hygiene was completed before initiation of ACTISORB Silver 220. No secondary dressing was required. The patient was encouraged to lift the skin fold, wash/cleanse with water, to avoid perfumed soaps/washes, and to dry gently before applying new dressings. The dressing frequency was dictated by the ability control odour or weekly.

Week 1

After 1 week, the ulceration had healed, and the pain and fungal infection had resolved. There was no malodour, even when skin folds were lifted. Although treatment goals had been achieved, due to concern arising from the intertrigo, it was decided to continue with ACTISORB Silver 220 as prophylaxis while ambulation improved, allowing the patient to better attend to his hygiene.

DISCUSSION

Both the patient and clinician were satisfied with the way the dressing stayed in place — it was simply folded and placed deep into the skin's natural fold/crease. The 10.5cm x 19cm size was sufficient to cover each side of the groin, and two pieces were used on the abdominal apron. The patient reported improvement in quality of life due to resolution of odour and the ability to continue rehabilitating his mobility. Due to the simplicity of application and ease of use, Mr B was able to be essentially self-caring during treatment for infection and for prophylactic treatment going forward. The patient was discharged before the next formal review, but the skin remained healed and infection-free up to discharge.



FIGURES 1A/1B.
Skin condition at
presentation



FIGURES 2A/2B.
Wound and groin
at week 1



CASE 6: RETROSPECTIVE: PERCUTANEOUS ENDOSCOPIC GASTROSTOMY TUBE

INTRODUCTION

Mr A, an 80-year-old male, was seen by the tissue viability team due to the leaking from his percutaneous endoscopic gastrostomy (PEG) feeding tube. The leakage had caused maceration and open sores on the skin surrounding the PEG. Signs of critical colonisation were present, including erythema and exudate, due to the microbial content of the backflow fluid from the PEG. Odour was present due to the developing microbial colonisation on the wound area.

He was on long-term immunosuppressant medications for treatment of cancer. The tissue viability team felt it important to choose a dressing that would not donate anything into the wound area. He was mobile but had very fragile skin due to his age and the medication regimen. No tape could be applied to the skin in this area.

CLINICAL ASSESSMENT AND TREATMENT

The PEG was replaced with a new tube. To manage the odour and address the signs of infection, the decision was made to initiate ACTISORB® Silver 220. To absorb the exudate from the wounds that had developed and to lower the microbial load on the skin, the dressing was wrapped around the fixator bar daily for 1 week. This was achieved by folding the dressing into a triangle and taping the dressing only to the fixator bar, and pushing the fixator bar down on the dressing. This method provides coverage and pressure if overgranulation is present.

DISCUSSION

After 3 days, the maceration had begun to clear, and the skin around the PEG ostomy had begun to improve. Odour had resolved. At the end of the week, the ulceration had healed without any issues with or interference to the new PEG. The patient remarked that the burning sensation he had been experiencing related to the wound had resolved 'very quickly'. He was able to change the dressing himself, and it stayed in place well. He was extremely happy with his treatment and the improvement in quality of life.



FIGURES 1A/1B.
Percutaneous
endoscopic
gastrostomy
tube and surrounding
skin upon presentation

FIGURES 2A/2B.
Percutaneous
endoscopic
gastrostomy
tube and surrounding
skin after
3 days' treatment with
ACTISORB® Silver 220

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