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Original Research Article

Early outcome of open wound dressing with tincture of benzoin compound versus closed wound dressing in clean wounds

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ABSTRACT

Background: Wound is disruption in the continuity of epithelial lining of skin or mucusa resulting from damage. The Aim of this study was to assess the effectiveness of open wound dressing with tincture of benzoin compound versus close wound dressing with gauze and plaster for post-surgery and other wounds less than 20 cm in length
Methods: The study adopted a form of quasi-experimental approach where the effects of the different wound dressing protocols were assessed. Informed consent was obtained from the patients before enrolling into the study. The patients for this research work were randomly divided into two groups; one group was dressed with gauze and plasters after the routine cleaning with antiseptic, while the other group after same routine cleaning had tincture of Benzoin compound applied to the skin and left open. The acceptability and comfort of the dressing used was ascertained from the patient using questionnaire. Data was analysed and a p value less than or equal to <0.05 was considered statistically significant.
Results: Open wound dressing with tincture of benzoin compound had better wound healing outcome, there was 65% wound healing requiring no further dressing, while closed wound dressing with gauze and plaster had 55%. Ninety-six percent prefer benzoin compound dressing while 74% prefer gauze and plaster. The 26% said if given another opportunity, they would not like to have gauze and plaster dressing compared to 4% that will use it.
Conclusions: Open wound dressing with tincture of benzoin compound is effective and has a comparable advantage over close wound dressing.

Keywords: Wound dressing, Benzoin compound, Open wound, Close wound

INTRODUCTION

A wound is defined as a disruption in the continuity of the epithelial lining of the skin or mucosa resulting from physical or thermal damage. According to the duration of healing process; wound is categorize as acute or chronic.

An acute wound is an injury to the skin or mucosa that occurs suddenly due to accident. It heals at predictable and expected time, usually within 8-12 weeks depending on the size, depth and extent of damage, while chronic wound on the other hand generally fails to progress through the normal stages of healing and cannot heal in orderly and timely manner.

Wound result on the skin when it is torn, cut, or punctured (an open wound) or where blunt trauma causes a contusion (a closed wound). In pathology, it specifically refers to a sharp injury which damages the epidermis of the skin.[1] The overall treatment depends on the cause, depth of the wound and whether other structures beyond the skin are involved.

Treatment of recent lacerations involves examining, cleaning, and closing of the wound. Minor wounds like bruises will heal on their own, with skin discoloration usually disappearing in 1-2 weeks.[2]

Puncture wounds may be prone to infection depending on the depth of penetration. The entry of puncture wound

should be left open to allow for bacteria or debris to be removed from inside.[3]

If closure of a wound is decided upon; a number of techniques can be used, these include bandages, acyanoacrylate glue, staples, and sutures. Absorbable sutures have some benefit over non absorbable sutures for not requiring removal.[4] Adhesive glue and sutures have comparable cosmetic outcomes for minor lacerations of about 5cm in adults and children.[5]

The use of adhesive glue is time saving and less pain for the patients. The wound treated by adhesive glue opens at a slightly higher rate but there is less redness and it should not be used in areas of high tension or repetitive movements such as joints or the posterior trunk.[5,6] In the case of clean surgical wounds, there is no evidence that the use of topical antibiotics reduces infection rates in comparison with non-antibiotic ointment. Antibiotic ointments can irritate the skin, slow healing and greatly increase the risk of developing contact dermatitis and antibiotic resistance.[7,8] Wound dressings are mainly employed to prevent bulk loss of tissue invasion by pathogens and are effective against trauma.

Chronic wounds such as diabetic, decubitus and a venous stasis ulcer require well planned dressing. The role of a wound dressing is to provide the optimum conditions for wound healing while protecting the wound from further trauma and invasion by pathogenic micro-organisms. It is also important that the dressings should be removed without any form of trauma so as to prevent further damage to the wound surface during change of dressing. For most serious types of wounds such as burns and chronic ulcers that produce large quantities of exudates, it is generally accepted that moist wound therapy plays an important role in effective treatment.[9,10] It is necessary to keep the wound bed moist to prevent cell death by desiccation, provide a favorable environment for fibroblast proliferation and allows re-epithelialization by the migration of keratinocytes from the wound edges across the surface of the newly formed granulation tissue. It is important to maintain a balance in moisture levels as excess wound fluid can contribute to an increase in bacterial colonization of the wound and can adversely affect the surrounding area by maceration of the healthy tissue.[11] It is extremely important therefore; to select an appropriate dressing material for the particular wound that will maintain the optimum moisture levels for wound healing to take place.

Currently, there are many types of wound dressing that are used to provide moist wound therapies, these includes; hydrocolloids, foams, hydrogels, carboxymethylated cellulose etc.

Wound dressing decreases the risk of infection and using correct material to cover wound optimizes the healing process.[12] The ideal dressing accomplishes the following: Maintains a high degree of humidity between the wound and the dressing, provides a thermal insulation for the wound which provides a better environment for cellular growth, removes excess exudate and toxic substances from the wound, allows gas exchange, should be impermeable to bacteria and should not leave particulate material or contaminants within the wound. Dressings are also indicated for the following: to apply the aesthetic principle of hiding the injury, to protect the wound from accidental trauma, abrasions, self-inflicted or other irritations, is also to provide support, immobilization, compression and to prevent hematoma or seroma formation.

Despite the use of antibiotics, wound infection still occur post operatively, even in cases without obvious predisposing factor except the breech in skin and is of serious concern to both patient and attending surgeon or clinician. A huge amount of money is spent on infected wound, especially when they become chronic. Chronic non-healing wounds affect millions of patients each year and contribute significantly to their morbidity and mortality. These wounds have a substantial impact because of their economic burden and the significant effect on reduction in quality of life, as well as the increased risk of death for those patients affected by them.[1] A 2014 study of Medicare data showed that chronic non-healing wounds and associated complications affect nearly 15% or 8.2 million Medicare beneficiaries. The study also estimated the cost of treating these wounds is between $28.1 billion and $31.7 billion annually. Studies have calculated the cost of wounds to the NHS in United Kingdom to be about £1bn yearly.[10,14]

The cost to the health system can be very significant, this is particularly so in developing countries.[16] The highest costs were associated with infected or reopened surgical wounds and outpatient care had the highest costs. Failure of a wound to heal increases time spent in the hospital and the expenses and may start a cascade of progressive complications with added cost and an increase in morbidity and mortality.

The clinical management of wounds is diverse; however, wound care therapies especially in resource poor setting are mostly dry gauze dressings with creams. There are reports of complications such as adverse reactions to dressing materials, tissue necrosis, gangrene, wound dermatitis, and periwound edema, hematomas, dehiscence which have been associated with wound dressing techniques or results from patient's preference.[10,13,15,16]

There are many wound dressing materials available. It is only after proper assessment of wound characteristics and knowledge of available products that the "ideal" dressing may be chosen. History of the patient and findings at surgery should guide the type of dressing. This research will add to knowledge and help in choosing the ideal material. Wound dressing with tincture of benzoin compound has been used as an antibiotic for superficial

wound infections and has well established uses in both allopathic and traditional forms of medicine. In the form of a tincture (i.e., a solution in alcohol) benzoin is used as an inhalant with steam for the relief of cough, laryngitis, bronchitis and upper respiratory tract disorders.[10,11,17] Several national pharmacopoeias including the British, Chinese, French, Italian, Japanese, Swiss, Thai and American recommend this drug as a local skin antibiotic solution for the topical treatment of itching skin rashes, wounds and ulcers. Compound Tincture of Benzoin is often applied to skin under adhesive bandage. It protects the skin from allergy to the adhesive and makes the bandage adhere longer.[3] It is also used by athletes for its reputation of toughening skin.

Chemistry of benzoin compound

Benzoin is 2-hydroxy-1, 2 diphenylethanone also called Benzolphenylcarbinol or hydroxyl 2 phenylacetone. It comes as white to yellow crystal solid with the odour of camphor.

Safety of benzoin compound

The use of benzoin compound for wound dressing is safe. Work done by Chembollu Lakshmi and Cherupathy Syinivas showed that two out of twenty-six patients had contact dermatitis when this compound is applied under occlusion to the skin and that the allergic dermatitis was easily treated topically with chlobetassol propionate for 7-10 days and noted no such reaction when applied without occlusion. They concluded it was safe natural substance and can rarely cause allergic contact dermatitis.[18] Post-surgical allergic contact dermatitis occurs in those who previously react to benzene in other preparation such as betadine; it was noted that 85% of such patient will react also when treated with tincture of benzoin compound and typical occur in 2-5 days of treatment.[18]

However, the paucity of data on the ideal wound dressings suitable for good wound healing in our local setting prompts the need for research into the effectiveness of the most commonly available wound dressings gave rise to this study.

Aim and objectives

The study intends to assess the effectiveness of open wound dressing with tincture of benzoin compound versus close wound dressing with gauze and plaster for post-surgery and other wounds less than 20 cm in length with the following objectives: To assess the effectiveness of open wound dressing with tincture of benzoin compound and closed wound dressing with gauze and plaster, to assess the early outcome of open wound dressing with tincture of benzoin compound comparing it to close wound dressing with gauze and plaster and to compare the acceptability of the treatment in terms of the comfort and psychological effect.

METHODS

The study adopted a quasi-experimental approach where the effects of the different wound dressing protocols on open wound and closed wounds were assessed.

Ethical/informed consent

Ethical approval to carry out the study was obtained from the research and ethics committee of the university of Port Harcourt teaching hospital (UPTH). Informed consent was obtained from the prospective subjects prior to their inclusion into the study. All subjects' personal information remained confidential and refusal to participate did not lead to denial of the requisite standard care for the patient.

Study location

The study was carried out in a tertiary hospital; University of Port Harcourt Teaching Hospital (UPTH) located in Obio/Akpor Local Government Areas of Rivers state, Nigeria.

The period of the study was one year, June 2020 to June 2021.

The sample size was calculated based on the formula sample size

For proportions as stated by Araoye et al below:[19]
$n=(z^2pq)/d^2$

Where, n=the minimum sample size. Z=standard normal deviation, usually set at 1.96

Corresponding to 95% confidence interval.

P=proportion of the target population used=15.6 based on A previous Nigerian study.

q=1.0-p

d=degree of accuracy desired (usually set at 0.05),
$n=(1.96^2\times0.15\times0.84)/0.05^2$,
$n=(3.8416\times0.15\times0.84)/0.0025$,
$n=(0.4840)/0.0025$, $n=193.64 \sim 194$

The 194 was split into two groups of 97 each as follows; Group A: 97 subjects with open wounds and group B: 97 subjects with closed wounds.

Inclusion criteria

Subjects presenting with wounds at accident and emergency rooms of study sites with wound requiring suturing, elective cases were included and these ranges from minor to major surgeries and for subject <18 years, consent was taken from parents were included in study.

Exclusion criteria

Subjects presenting with diabetic foot ulcers, subjects with known chronic co-morbidities and subjects with known allergies to Benzoin compounds were excluded from the study.

Wound assessment and wound dressing protocol

The wound assessment was done on each of the wounds before and after wound dressing, using the national wound assessment form.

The assessment involved bio data, factors that impaired wound healing both locally and systemically. The patient's nutritional pattern, intake of drugs and other substances were noted. This was followed by examination of the wound. The measurement of wound size was done using a ruler. It included the length, width and depth of the wound. Further assessments were done 4th to 5th day post initial dressing to assess healing which included assessing wound edge apposition, the surrounding tissue, tenderness and other signs of inflammation. A second assessment was done on the 12th to 14th day and further assessment when necessary was done. At this stage, the acceptability and comfort of the dressing used was ascertained from the patient using questionnaire.

All open wounds were dressed using standard protocols and procedures while tincture of benzoin compound was applied to the skin. The patients for this research were randomly divided into two groups, one group was dressed with gauze and plasters after the routine cleaning with antiseptic, while the other group after same routine cleaning had tincture of benzoin compound applied to the skin and left open. The subjects with tendency to bleed after surgery or have haematoma formation were excluded from open wound dressing, the rest were randomized as follows; the subjects were asked to pick 1 out of 200 opaque envelopes each containing small wrapped paper labeled O or C, the subjects opened the picked envelopes and further blindly picked from it any of the wrapped papers which is now opened to find out the treatment group the patient belonged. O for open dressing and C for closed dressing

Data collection

The patients were drawn from accident and emergency ward and Theatre where the initial assessment and dressing was done. Further assessment was at the wards and or dressing rooms. Those that were involved in the data collection process including dressing were the research assistances. They helped to assess the size of the wound and wound surroundings. They were provided with rulers and the format for wound assessments. The researcher generally supervises and coordinates the entire procedure and briefed them on what to do and to look at for.

Data analysis

Descriptive statistics was used to present the data on the wounds as appropriate. The chi-square test was used to assess differences in the wound edge, tissue types and infection between both groups. All analysis was done with the statistical package for social sciences (SPSS, IBM, USA) software version 21 and a p value less than or equal to 0.05 was considered statistically significant.

RESULTS

Most of the subjects in the study are of the younger age group 1-40 years which constituted 59% for open wound dressing while 63% for closed wound dressing. Male constituted 59% and female were 41% in open wound dressing, while 51% and 41% respectively for male and female in closed wound dressing.

Wound were assessed on the 5th day post dressing and again on the 12th day, at first assessment, open wound dressing with tincture of benzoin compound had (65%) very good wound healing requiring no further dressing, while closed wound dressing with gauze and plaster had 55%.

It was noted that 32% in open wound dressing and 33% in closed wound dressing were in the category of satisfactory requiring just one more dressing to achieve 100% wound healing by length. 3% were in the category of fair wound healing and required more than one time dressing to achieve 100% wound closure while that of closed wound dressing was 12.0%.

Factors associated with the effectiveness of open wound dressing with tincture of benzoin compound and close wound dressing with gauze and plaster.

No plaster-like reaction in open wound dressing whereas in closed wound dressing (12%), had plaster-reaction. 2% showed evidence of superficial wound sepsis with Benzoin compound whereas 8% for closed wound dressing with gauze and plaster.

Six percentages complained of itching in open wound dressing compared to 20% in closed wound dressing. Feeling of burning sensation immediately after application of dressing was found in 2% of cases in open wound dressing, No such report in closed wound dressing.

Ninty-six preferred benzoin compound dressing while 74% preferred gauze and plaster. The 26% said if given another opportunity, they would not like to have gauze and plaster dressing compared to 4% in open wound dressing with benzoin compound.

Twenty percent rated good while 80% rated very good, whereas 8% rated closed wound dressing with gauze and plaster as poor and 30% rated good, 62% rated very good.

Table 1: Age and sex group of the study population.

Research variables	Open wound, n=100 (%)	Close wound, n=100 (%)	Chi-square (χ2), p
Age (in years)			
1-10	5 (5.0)	8 (8.0)	P=0.714μ
11-20	13 (13.0)	19 (19.0)	
21-30	29 (29.0)	21 (21.0)	
31-40	12 (12.0)	15 (15.0)	
41-50	9 (9.0)	8 (8.0)	
51-60	11 (11.0)	12 (12.0)	
61-70	15 (15.0)	11 (11.0)	
≥ 71	6 (6.0)	6 (6.0)	
Gender			
Male	59 (59.0)	51 (52.0)	χ2=0.72, p=0.393
Female	41 (41.0)	49 (48.0)	

*Statistically significant (p<0.05); μ=Fisher's exact p (recommended for numbers <5)

Table 2: Assessing the effectiveness of open wound dressing with tincture of benzoin compound compared to closed wound dressing with gauze and plaster.

Research variables	Open wound, n=100 (%)	Close wound, n=100 (%)	Chi-square (χ2), p
Length of wound			
2-5	24 (24.0)	20 (20.0)	χ2=3.94, p=0.268
6-10	36 (36.0)	29 (29.0)	
11-15	22 (22.0)	32 (32.0)	
16-20	18 (18.0)	25 (25 .0)	
Wound type			
Biopsies	21 (21.0)	15 (15.0)	χ2=19.81, p=0.001*
Intermediate	39 (39.0)	16 (16.0)	
Major	20 (20.0)	41 (41.0)	
Exploratory laparotomy RTA cases	20 (20.0)	28 (28.0)	
Range of wound healing by length%			
100% (Very good)	65 (65.0)	55 (55.0)	p=0.0423μ*
98-99% (Satisfactory)	32 (32.0)	33 (33.0)	
86-96% (Fair)	3 (3.0)	12 (12.0)	
Outcome of wound dressing 12 days			
Well apposed	98 (98.0)	90 (90.0)	p=0.001μ*
Partially apposed/wound breakdown	2 (2.0)	10 (10.0)	

*Statistically significant (p<0.05); μ=Fisher's exact p (recommended for numbers <5)

Table 3: Differences in the effectiveness of open wound dressing with tincture of benzoin compound and close wound dressing with gauze and plaster.

Research variables	Open wound, n=100 (%)	Close wound, n=100 (%)	Chi-square (χ2), p
Plaster reaction			
Yes	0 (0.0)	12 (12.0)	p=0.001μ*
No	100 (100.0)	88 (88.0)	
Itching			
Yes	6 (6.0)	20 (20.0)	p=0.005μ*
No	94 (94.0)	80 (80.0)	
Redness			
Yes	2 (2.0)	10 (10.0)	p=0.003μ
No	98 (98.0)	90 (90.0)	
Edematus periwound			
Yes	3 (3.0)	12 (12.0)	p=0.006μ
No	97 (97.0)	88 (88.0)	

Continued.

Research variables	Open wound, n=100 (%)	Close wound, n=100 (%)	Chi-square (χ2), p
Superficial wound sepsis			
Yes	2 (2.0)	8 (8.0)	p=0.101μ
No	98 (98.0)	92 (92.0)	
Further wound dressing before good healing			
Yes	2 (2.0)	10 (10.0)	p=0.002μ*
No	98 (98.0)	90 (90.0)	
Burning sensation			
Yes	2 (2.0)	0 (0.0)	p=0.4970μ
No	98 (98.0)	100 (100.0)	
Staining of cloth			
Yes	0 (0.0)	0 (0.0)	p=0.001μ*
No	100 (100)	100 (100)	
Sticking to cloth			
Yes	0 (0.0)	0 (0.0)	p=0.001μ*
No	100 (100)	100 (100)	

*Statistically significant (p<0.05); μ=Fisher's exact p (recommended for numbers <5).

Table 4: Patient rating and acceptability data.

Research variables	Open wound dressing, n=100 (%)	Close wound dressing, n=100 (%)	Chi-square (χ2), p value
Rating method			
Poor	0 (0.0)	8 (8.0)	p=0.001μ*
Good	20 (20.0)	30 (30.0)	
Very good	80 (80.0)	62 (62.0)	
Preferred method			
Yes	96 (96.0)	74 (74.0)	p=0.001μ*
No	4 (4.0)	26 (26.0)	

*Statistically significant (p<0.05); μ=Fisher's exact p (recommended for numbers <5)

Figure 1: Open wound dressing with tincture of benzoin.

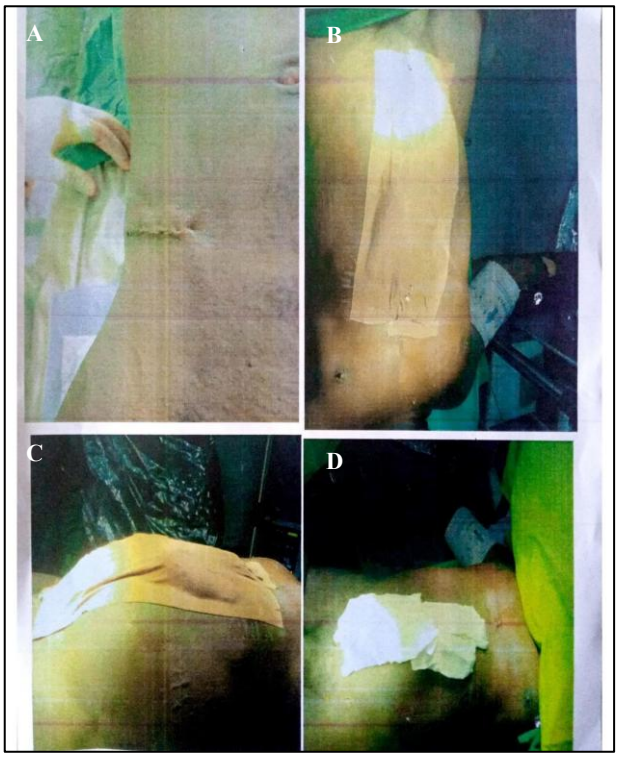

Figure 2 (A-D): Wound dressing with gauze and plaster.

DISCUSSION

Closed wound dressing using gauze and plaster is well known and common in hospitals and clinics. Open wound dressing is also being practiced with other ointments like topical silver suphadiazine, gentian violet (GV) etc. In this study, tincture of Benzoin compound was used for open wound dressing, the result showed that Benzoin compound was very effective. On the 5th day post dressing assessment, open dressing had 65% very good wound healing while closed wound dressing had 55%; only 3% required more than one-time dressing to achieve 100% wound closure whereas 12% did so in closed wound dressing. This showed that open wound dressing with Benzoin compound had better wound outcome.

Patients older than 30 years had better wound healing with only 5.66% required more than one-time wound dressing whereas in closed wound dressing 17.31% required further dressing to achieve 100% healing. Open wound dressing with Benzoin compound had increased healing outcome in the elderly, this outcome could be the effects of the properties of tincture of Benzoin compound already stated in the literature (antiseptic, anti-inflammatory and adhesive properties).[20,21]

There is no sex difference in wound healing with open wound dressing but in closed wound dressing there was difference in sex. The 45.10% male compare with 65.31% female had very good wound healing, also 17.65% of male compared with 6.12% of female. Comparatively female do better than male with closed wound dressing as against no difference in open wound dressing. This outcome could not be readily explained, but could be due to behavioral differences and others not tasted in this work may be attributed. The overall outcome on the last day of the assessment showed: open wound had 98% well appose wound with only 2% partial wound breakdown whereas closed wound dressing had 90% with 10% wound breakdown.

Open wound dressing with tincture of benzoin compound had more healing effect, this is similar to the publication by Gosselin et al (open wound dressing had better early outcome than closed wound dressing).[22]

Elective cases

The elective cases had very good outcome in both methods whereas emergency and trauma cases produce more of the poor outcome. However, in open dressing 2% of wound breakdown were from trauma whereas in closed dressing the figure rose to 10%. Therefore, wounds that were contaminated prior to surgery do better with open dressing.

In both open and closed wound dressing, the reactions were mild and did not require further medication (steroid treatment) compared to previous work done with compound benzoin under occlusive dressing that require three days' steroid treatment for healing. In previous publication 2 out of 26 patients had contact dermatitis (7.69%) when this compound was applied in an occlusion to the skin.[19] In this study, it was applied without occlusion and 2 out of 100 had mild dermatitis requiring no further treatment. Against what was published; antibiotics ointments can irritate the skin, slow wound healing and greatly increase the risk of developing contact dermatitis.[8] Also in this study, wound healing was better in the open wound when compared to closed wound dressing with gauze and plaster

The study did not estimate wound depth and area because of the method used which is the one readily available for this study, and moreso, most of the wounds were incisional and had straight edges. There is no doubt that sophisticated devices like Silhouette star camera with prop will have added more findings and color to the study.

Bed staining and sticking to clothing; this was identified in open wound dressing with topical silver sulphadiazine by Olawoye and Ayoade this effect was not seen with open dressing with Benzoin compound.[23]

Safety

Both methods are safe causing no severe reaction to patient, this can be compared with work done by Newman and Koch which demonstrated the safety of closed wound dressing in head and neck surgery.[24]

This study did not assess other influences on wound healing that was seen during the assessment e.g. The various techniques used, the incision and the closure for elective cases and emergencies. In literature, these can influence the outcome.[25,26] The closure of wound was not done by one person but by many (surgery-gynaecological cases were included). where the knot lies between the edges of the wound. However, this is insignificant to influence the outcome

CONCLUSION

Open wound dressing with tincture of benzoin compound is very effective and has a comparable advantage over close wound dressing in cases that it can be applied. The reactions are quite mild and do not require further medications. Majority prefer open wound dressing with benzoin compound; it removes the psychology of carrying heavy plaster dressing. It is cost effective, a bottle of benzoin compound containing 100mls was used for 100 patients and still remain about 20mls, whereas 4 rolls of big plaster and three roles of big size gauze for open wound dressing was used for 100 patients.

Recommendations

Open wound dressing is strongly recommended as a practical option in resource constrained setting. It is also

recommended for wound that is likely contaminated as its properties would help healing in such situation. Open wound dressing does not require skill and elaborate of specialized training; therefore, it is strongly recommended were skilled health workers and medical personnel are not readily available.

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