Syringe Shield Use Survey

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The opinions of technologists on the use of syringe shields were surveyed. The majority of respondents felt that syringe shields significantly reduced radiation exposure and should be used. Of five general categories of syringe shields, the thin wall lead or tungsten and leaded glass window shield was used most frequently. The 100% leaded glass shields were used half as often (almost as consistently as the thin wall type) and received the highest ratings for a variety of syringe shield characteristics. Lead shield or wrapping with no viewing window was used the least and received the poorest ratings.

Use of syringe shields is a controversial issue in nuclear medicine. The U.S. Nuclear Regulatory Commission (NRC) encourages the use of syringe shields in the Regulatory Guide 10.8 (*1*). This document is not a set of regulations but rather guidelines that the NRC accepts as meeting the minimum requirements for the NRC license all nuclear medicine departments must have. Therefore, some in nuclear medicine consider syringe shield use mandatory while others feel that syringe shields must be available but their actual use is up to the discretion of the person preparing or administering patient doses. The NRC has also made the "as low as reasonably achievable" (ALARA) concept a regulatory requirement (*2*). ALARA recommends that action levels for exposures not exceed given dose equivalents, which are some fraction of the maximum permissible dose (MPD) (*3*). "Included in a nuclear medicine license should be systemized procedures to ensure ALARA, and should incorporate the use of special equipment such as syringe shields, rubber gloves, etc." (*3*).

Several studies indicate that the use of syringe shields does reduce exposure. In 1976, Branson et al. reported that syringe shields reduced physician hand exposure by 20–80% during injection of Tc-99m doses and that a radiopharmacist's exposure was reduced by 50% during preparation (*4*). Williams, Sodd, and Branson reported in 1979 that the use of syringe shields reduced exposure five-fold in kit preparation and syringe filling of Tc-99m (*5*). A study by Damm states that exposure values from unshielded syringes containing Tc-99m are 200 times that of shielded syringes (*6*).

The controversy over use of syringe shields does not concern their ability to reduce exposure but rather whether this reduction is worth the added trouble involved in using them. Since there are many designs for syringe shields, it is important to pick a shield that technologists find convenient to use.

Materials and Methods

A survey regarding opinions of technologists toward syringe shield use was mailed to all 560 technologist members of the Society of Nuclear Medicine's Central Chapter. There were 217 responses. Only four had never used any kind of syringe shield. These were excluded from the analysis. There were also two incomplete responses that were not used. Therefore, the final data consisted of the 211 respondents who had used syringe shields. This was a 37.7% response.

Results and Discussion

Eight questions about the use of syringe shields were asked. The responses are shown in Table 1; one obvious

TABLE 1. Percentage of Syringe Shield Users Who Responded to Each Question with Agreement

	Per cent agreeing	Per cent responding*
They do significantly reduce radiation exposure	90.9%	98.6% (3 missing)
Any reduction in exposure (no matter how much) is enough to warrant their use	85.6%	99.1% (2 missing)
They are relatively convenient to use	66.8%	98.6% (3 missing)
They should be used during preparation of radiopharmaceuticals	79.4%	99.1% (2 missing)
They should be used during drawing up of doses	69.7%	98.6% (3 missing)
They should be used during injection of doses	82.9%	100%
Persons preparing and/or administering radioactive doses should be required to use them	53.8%	99.5% (1 missing)
Persons preparing and/or administering radioactive doses should only be encouraged (not required) to use them	60%	97.2% (6 missing)

*There were 211 respondents to the survey but not all answered each question.

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TABLE 2. Number Using Each Type of Syringe Shield

	Per cent of total users	Number of users
100% leaded glass	16.6%	73
Thin wall lead or tungsten and leaded glass window	33.6%	148
Thick wall lead and leaded glass window	33.1%	146
Lead shield or wrapping with no view window	14.7%	65
Others	2%	9
	Total Users	=441*

*Many people used more than one type of shield.

TABLE 3. Frequency of Use of Syringe Shield Types

	Per cent who used syringe shields			
	Rarely (1-10% of time)	Occasionally (10-50% of time)	Usually (50-90% of time)	Constantly (90-100% of time)
100% leaded glass	17.8%	15.1%	27.4%	39.7%
Thin wall lead or tungsten and leaded glass window	16.2%	16.2%	23.6%	43.9%
Thick wall lead and leaded glass window	37.0%	26.7%	17.1%	19.2%
Lead shield or wrapping with no viewing window	56.9%	12.3%	16.9%	13.8%
Other	11.1%	33.3%	22.2%	33.3%

conclusion is that technologists who use syringe shields favor their use. Nearly all respondents agreed that syringe shields *do* significantly reduce radiation exposure. Most agreed that any reduction in exposure is enough to warrant syringe shield use and that syringe shields should be used when injecting doses, preparing radiopharmaceuticals, and drawing up doses. There was greater agreement about the use of syringe shields during injection than about their use during preparation and drawing up doses. This is probably because less manipulation of the shield (i.e., reading volumes, removing air bubbles, etc.) is required during injection (*4*). However, we have found that higher exposures to the hand occur during preparation and drawing up doses than during injection (*7*). By a smaller majority, technologists also agreed that syringe shields are relatively convenient to use, that nuclear medicine personnel should be *encouraged* to use them, and even (by a very slim majority) that technologists should be *required* to use them.

Technologists who had used particular syringe shields were asked which types they had used and how often they used them (Tables 2 and 3). Of the four types specifically named, the thin wall lead or tungsten with leaded glass window type and the thick wall lead with leaded glass window type were each used by one-third of the respondents. The thin wall type was used constantly by a higher percentage of its users than any of the other types, although the 100% leaded glass type was used constantly by almost as great a percentage. Although there were almost as many thick wall as thin wall users the former used their shields much less frequently. The lead shield with no window was used least frequently.

Technologists were also asked to rate the characteristics of each shield type that they had used (Table 4). Of the specifically named types the 100% leaded glass shield received the best overall rating; the majority of its users rated its visibility as excellent and its other characteristics as satisfactory. The majority of users of the thin wall lead or tungsten with leaded glass window type rated each of its characteristics as satisfactory. The majority of thick wall lead with leaded glass window users considered its handling and efficiency to be poor. Finally, the lead shield or wrapping with no viewing window received the poorest ratings, with the majority of its users rating handling as satisfactory but all the other characteristics as poor.

Many people added comments to the end of their surveys. These indicated that no type of shield was completely satisfactory. Although the 100% leaded glass shields received the best ratings, users complained about their bulk, fragility, and high cost. Other types of shields received similar complaints.

Since this was a mail survey there may have been inherent biases related to differing interpretation of questions. Non-users of syringe shields may have felt the survey was not meant for them in view of the low number of non-user responses. Inclusion of responses from users only has probably revealed a more positive attitude toward syringe shields than would have been found had non-users responded as readily.

Conclusion

An opinion survey of users of syringe shields seems to indicate that:

- ☐ users do feel that shields significantly reduce radiation exposure;
- ☐ users favor the use of syringe shields, at least part of the time or during certain operations;
- ☐ although thin wall lead or tungsten and leaded glass window shields had the most users, 100% leaded glass shields received the best overall rating; and
- ☐ lead shield or wrapping with no viewing window received the poorest rating and was used the least.

TABLE 4. Syringe Shield Characteristics

	Visibility (%)			Handling (%)			Syringe fit (%)			Overall Efficiency (%)		
	P	S	E	P	S	E	P	S	E	P	S	E
100% leaded glass	5.6	22.5	71.8 *	13.0	59.4 *	27.5	11.8	47.1 *	41.2	12.9	48.6 *	38.6
Thin wall lead or tungsten and leaded glass window	17.3	68.0 *	14.7	12.7	58.0 *	29.3	12.7	52.0 *	35.3	15.6	55.1 *	29.3
Thick wall lead and leaded glass window	32.4	58.6 *	9.0	54.2 *	40.3	5.6	27.1	57.9 *	15.0	42.8 *	41.3	15.9
Lead shield or wrapping with no viewing window	89.1 *	10.9		45.3	48.4 *	6.3	50.8 *	32.3	16.9	57.9 *	32.8	9.4
Others	14.3	42.9 *	42.9 *		42.9	57.1 *		57.1 *	42.9		57.1 *	42.9

P = poor, S = satisfactory, E = excellent. *Indicates the rating (P,S,E) with the highest percentage of responses under each characteristic.

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